A Study of the Fishery Resources of Tuktoyaktuk Harbour, Southern Beaufort Sea Coast, with Special Reference to Life Histories of Anadromous Coregonids

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ABSTRACT

Bond, W.A. 1982. A study of the fish resources of Tuktoyaktuk Harbour, southern Beaufort Sea coast, with special reference to life histories of anadromous coregonids. Can. Tech. Rep. Fish. Aquat. Sci. 1119: vii + 90 p.

The fish fauna of Tuktoyaktuk Harbour and the adjacent waters of Kugmallit Bay was sampled between July, 1979, and March, 1981, to document seasonal movement patterns in the vicinity of Tuktoyaktuk, to define the purpose of these migrations, and to acquire baseline data on the age and growth characteristics, sex ratio and maturity, and food habits of the various fish species.

Fifteen fish species, representing eight families, were identified from gillnet and seine catches. Seines produced the most fish, accounting for 63.8% of the total catch. Overall, samples were dominated by six anadromous species which accounted for 71.4% of all fish taken. Among the anadromous forms least cisco predominated (43.8%), followed by Arctic cisco (26.8%), broad whitefish (13.7%), lake whitefish (7.6%), rainbow smelt (5.2%), and inconnu (2.7%). Fourhorn sculpin was the most abundant (49.5%) of the six species considered to be brackish water or marine forms. Other species in this group included starry flounder (19.1%), Pacific herring (16.1%), Arctic flounder (12.8%), saffron cod (2.4%), and eelpout (0.1%).

Results of the present study suggest that the anadromous coregonids occurring in the vicinity of Tuktoyaktuk are primarily non-spawning members of the migratory populations whose spawning sites are located in the Mackenzie River and its tributaries. Few sexually mature coregonids were captured.

Broad whitefish, lake whitefish, and least cisco were seldom captured during the winter but were common in nearshore areas throughout the summer. The abundance of all three species increased greatly in early September, suggesting a movement from summer feeding areas to overwintering locations at that time.

Tuktoyaktuk Harbour is a major overwintering area for Arctic cisco. A large migration of non-spawning cisco entered the bay in September and this species was abundant below the halocline throughout the winter. A migration out of the bay took place around the time of break-up. Some of the Arctic cisco leaving the bay at this time had matured sexually over the winter.

The bay also appears to be an important overwintering area for inconnu which leave shortly after break-up for coastal feeding locations.

The other anadromous species, rainbow smelt, appears inside Tuktoyaktuk Harbour in mid-summer but does not overwinter there.

Pacific herring enter Tuktoyaktuk Harbour in large numbers during the autumn. Herring overwinter in the bay, spawn in June, and appear to leave the bay immediately after spawning. Fourhorn sculpin (January), Arctic flounder (March), saffron cod (March), and starry flounder (June-July) are also believed to spawn inside Tuktoyaktuk Harbour.

Large numbers of young-of-the-year least cisco and Arctic cisco entered Tuktoyaktuk Harbour during July but their abundance decreased during August.

Key words: Fishery surveys; catch/effort; anadromous coregonids; Pacific herring; migrations; life history; Mackenzie River; estuaries; Tuktoyaktuk Peninsula.

RESUME

Bond, W.A. 1982. A study of the fish resources of Tuktoyaktuk Harbour, southern Beaufort Sea coast, with special reference to life histories of anadromous coregonids. Can. Tech. Rep. Fish. Aquat. Sci. 1119: vii + 90 p.

On a échantillonné les poissons du Tuktoyaktuk Harbour et des eaux avoisinantes de Kugmallit Bay entre les mois de juillet, 1979, et de mars, 1981, pour étudier les migrations saisonnières près de Tuktoyaktuk et en définir le but, ainsi qu'obtenir des données de base sur l'âge et la croissance, le taux de masculinité et la maturité, et les habitudes alimentaires des diverses espèces.

La pêche au filet maillant et à la senne a permis l'identification de quinze espèces provenant de huit familles différentes. La pêche à la senne a donné les meilleurs résultats, soit 63,8% de l'ensemble des prises. En général, six espèces anadromes ont dominé les échantillons, comptant pour 71,4% de la prise totale. Le cisco sardinelle fut l'espèce anadrome la plus nombreuse (43,8%), suivi du cisco arctique (26,8%), du corégone tschir (13,7%), du grand corégone (7,6%) de l'éperlan arc-en-ciel (5,2%) et de l'inconnu (2,7%). Le chabot de profondeur fut le plus nombreux (49,5%) des six espèces considérées comme étant saumâtres ou marines. Ce dernier groupe comprenait également la plie étoilée (19,1%) le hareng du Pacifique (16,1%), la plie arctique (12,8%), la morue arctique (2,4%) et la lotte (0,1%).

Les résultats de cette étude semblent indiquer que les corégonides anadromes de Tuktoyaktuk qui ne sont pas à l'état de frai proviennent des populations migratoires qui frayent dans la Mackenzie River et ses affluents. Les prises ne comprenaient que quelques corégones ayant atteint la maturité sexuelle.

Peu de corégones tschir, de grands corégones ou de ciscos sardinelles ont été pris en hiver, alors qu'en été, ils se trouvaient en assez grand nombre dans les eaux côtières. Le nombre de ces trois espèces s'est fortement accru au début de septembre, ce qui indiquerait une migration à partir de leur habitat estival vers les endroits où ils hivernent.

En hiver, le Tuktoyaktuk Harbour accuse une forte population de ciscos arctiques. Un grand nombre de ciscos qui ne sont pas à l'état de frai entrent dans la baie en septembre pour y passer l'hiver sous la halocline. La migration en sens inverse a lieu au moment de la débâcle. Certains de ces ciscos atteignent la maturité sexuelle au cours de l'hiver.

La baie semble également accueillir un grand nombre d'inconnus pendant l'hiver. Ceux-ci regagnent les eaux côtières riches en nourriture peu après la débâcle.

L'autre espèce anadrome, l'éperlan arc-en-ciel, entre dans le Tuktoyaktuk Harbour au milieu de l'été, mais n'y hiverne pas.

A l'automne, le hareng du Pacifique entre en grand nombre dans le Tuktoyaktuk Harbour pour y passer l'hiver. Ils quittent la baie tout de suite après la frai qui a lieu en juin. On croit également que le chabot de profondeur (janvier), la plie arctique (mars), la morue arctique (mars) et la plie étoilée (juin et juillet) frayent dans le Tuktoyaktuk Harbour.

Le Tuktoyaktuk Harbour accueille une forte population d'alevins de ciscos sardinelles et de ciscos arctiques en juillet, mais leur nombre décroit en août.

Mots-clés: études sur la pêche; prises/effort; corégones anadromes; hareng du Pacifique; migrations; cycle évolutif; Mackenzie River; estuaires; péninsule de Tuktoyaktuk.

INTRODUCTION

The Mackenzie Delta and nearshore areas of the southern Beaufort Sea support large and important populations of anadromous and marine fish. Throughout the summer and autumn large numbers of mature coregonids pass through the Delta, migrating upstream from overwintering sites to spawning areas located throughout the Mackenzie system (Hatfield et al. 1972; Stein et al. 1973; Percy 1975; de Graaf and Machniak 1977). Extensive coregonid movements also occur along the coast of the Tuktoyaktuk Peninsula as fish migrate between overwintering locations and summer feeding areas. For some species, such as Arctic cisco, major feeding and rearing areas are located in bays and lagoons along the coastal margin (Lawrence et al. in prep.). For others, such as broad whitefish, lake whitefish, and least cisco, the brackish inshore zone also serves as an access corridor to rich feeding areas located in freshwater lake systems along the peninsula (Fallis et al. in prep.; Lawrence et al. in prep.). Along their migration routes the anadromous coregonids form the basis of numerous native domestic fisheries, providing an important nutritional source for the local people.

Although seemingly remote, these fish populations are not immune from the effects of modern industrial progress. Industrialization is occurring in many areas of Arctic Canada. This trend is especially evident in the western Arctic where the pace of industrial activity is accelerating rapidly as an increasing emphasis is placed on the exploration and development of the hydrocarbon reserves that lie beneath the Beaufort Sea. As development proceeds the threat of large-scale damage to fish and fish habitat will increase accordingly.

The greatest single concern in arctic waters is the threat of a major oilspill as might result from a blowout or damaged tanker (Milne and Smiley 1976; Gamble 1979). However, chronic pollution and physical disruptions resulting from increased construction activities both inshore and offshore could also produce serious effects on the fish stocks. Inshore activities, for example, that might impede the movement of fish along the Beaufort coast or prohibit access to feeding, rearing, and overwintering areas along the Tuktoyaktuk Peninsula, could prove extremely detrimental. Such effects are likely to be felt first in the vicinity of Tuktoyaktuk which has emerged as the base of operations for the petroleum industry. Here, industrial development has increased dramatically in recent years. Tuktoyaktuk Harbour is undergoing increased shoreline development and vessel traffic, and may soon be upgraded to the status of a public harbour. Dredging activity is increasing and minor oil spills within the harbour are already a common occurrence. Such events may impact negatively upon the fish resources of the area. Successful mitigation of such impacts demands an adequate data base relative to the fish resource, including complete descriptions of life history patterns and of habitats critical to the maintenance of the various fish populations. The purpose of the present study was to describe seasonal changes in the fish community of Tuktoyaktuk Harbour and to assess the significance of the harbour in terms of providing spawning, feeding, rearing, and overwintering areas for marine and anadromous fish.

DESCRIPTION OF THE STUDY AREA

Tuktoyaktuk Harbour is located on the Tuktoyaktuk Peninsula at the eastern edge of the Mackenzie Delta (Fig. 1). Most of the Tuktoyaktuk Peninsula consists of Pleistocene sediments, primarily medium to fine sand, underlain by massive sheets of ground ice and covered by tundra vegetation (Mackay 1963). The highly indented coastline is low-lying with altitudes generally within 10 m of sea level.

The tides at Tuktoyaktuk, described as semidiurnal (Dohler 1964), have a normal range of about 0.4 m, but can vary by up to 3 m as a result of storm surges (Henry 1975).

The climatology of the area has been reviewed in detail by Burns (1973). At Tuktoyaktuk extreme temperatures during the year can vary from 25°C to -50°C. Daily mean temperature is highest in July (10°C) and lowest in January and February (-30°C). The mean date of last frost is 30 June while first frost usually occurs about 20 August. Mean annual precipitation is less than 25 cm, most of which falls as rain during July and August. Freeze-up generally occurs in September or October with breakup occurring in late June. Ice thickness is greatest in May when it varies from two to three metres.

The hamlet of Tuktoyaktuk, with a native population of about 750, is situated on the east side of a north-south oriented peninsula, 150 to 300 m in width (Mackay 1963). The waters of Tuktoyaktuk Harbour communicate with Kugmallit Bay through two narrow channels separated by Tuktoyaktuk Island, a narrow, flat-topped island approximately 15 m high and 1500 m in length.

Tuktoyaktuk Harbour itself is about 6.5 km long and up to 1.8 km wide. The maximum depth is about 26 m (Barber 1968) but depths are less than 10 m in most places. The shoreline of the harbour is indented by bays and broken by three major inlets, Freshwater Creek, Mayogiak Inlet, and Reindeer Creek (Fig. 2).

Salinity features of Kugmallit Bay and Tuktoyaktuk Harbour have been reviewed by Barber (1968) and Milne and Smiley (1976). Under ice cover fresh Mackenzie River water accumulates in inshore areas of Kugmallit Bay, preventing influx of salt water into Tuktoyaktuk Harbour. An upper freshwater layer begins to develop in the harbour in early December and deepens to about 6 m by late spring. A sharp halocline separates the two layers as salinity measurements in the upper layer are less than $1\ g \cdot L^{-1}$ while those in deeper waters may exceed $30\ g \cdot L^{-1}$. During summer, winds mix the fresh water in Kugmallit Bay with more saline sea water, and the salinity in inshore areas and in the upper waters of Tuktoyaktuk Harbour becomes greater, increasing to at least $13.7\ g \cdot L^{-1}$.

Surface water temperatures in Tuktoyaktuk Harbour may reach 15°C during the summer while bottom temperatures remain near 0°C. In winter, temperatures in the surface layer remain close to 0°C while those below the halocline may drop to -0.5°C.

Salinity, temperature, other water quality parameters, and primary productivity are the subjects of a study currently being conducted in Tuktoyaktuk Harbour by the Department of Fisheries and Oceans (de March in prep.).

MATERIALS AND METHODS

SEDIMENT ANALYSIS

Material for analysis of particle size distribution and organic content was obtained from Ekman dredge samples taken at 24 locations in Tuktoyaktuk Harbour on 11-12 September 1980 (Fig. 2). Cores (3.8 cm diameter) obtained from the grab samples were frozen and kept frozen until the time of analysis. Sediment texture was evaluated by the dry sieve method (Welch 1948), resulting in separation of sediments according to particle size as described by the Wentworth scale (Wentworth 1922). The names and size ranges for the various particles are as follows:

Cobble	<40	but	>25.0	mm
Pebble	<25.0	but	>4.75	mm
Granule	<4.75	but	>2.00	mm
Very Coarse Sand	<2.00	but	>1.00	mm
Coarse Sand	<1.00	but	>0.50	mm
Medium Sand	<0.50	but	>0.25	mm
Fine Sand	<0.25	but	>0.125	mm
Very Fine Sand	<0.125	but	>0.063 (63 μ)	mm
Silt	<63 μ	but	>3.9 μ	
Clay	<3.9 μ			

The silt and clay fractions were separated using the pipette method described by Rukavina and Duncan (1970).

Following separation each fraction was weighed separately (±0.01 g) and the result expressed as a percentage of the total sample weight. During the separation process small amounts of sediment were usually lost. These losses ranged up to 4.55% and averaged 1.64% of the total sample weight.

To determine the organic content of the sediments, samples (5-10 g) were divided into two approximately equal portions. The two portions were treated separately and the results combined to produce the sample result. Each portion was weighed (±0.0001 g) in a pre-weighed crucible, combusted at 500°C, and then reweighed, the weight loss representing the organic content. This value was expressed as a percentage of the total sample weight.

BENTHIC MACROINVERTEBRATES

The benthic macroinvertebrate fauna of Tuktoyaktuk Harbour was sampled on 11-12 September 1980 using an improved Ekman-type grab (Burton and Flannagan 1973). Single grab samples were taken at 24 locations (Fig. 2) which were selected to provide coverage of a wide range of depths. After removal of core samples for particle size analysis the grab samples were screened through a 200 u sieve and the animals fixed in 10% formalin. The fixed samples were later transferred to 70% ethanol. In the laboratory the animals were counted and identified to class. The samples were retained for more specific identification.

FISH

Capture methods

The fish populations of Tuktoyaktuk Harbour were sampled between 25 July 1979 and 23 March 1981 using Swedish survey-type gillnets, regular gillnets, and small mesh seines. The Swedish nets were 60 m long by 1.8 m deep and consisted of equal lengths of 10, 19, 33, 45, 55, and 60 mm multifilament nylon mesh (bar measure). These nets were set at 13 locations (Fig. 3) during the study and were the only capture method used both under ice and during the open water period. All sets were made on the bottom except at Sites 9 and 12 on 10 January 1981 when the nets were suspended in the water column, although below the halocline. The five main stations fished with this gear inside the harbour (Sites 3, 6, 7, 8, and 9) were sampled several times each under ice and at approximately two-week intervals from 9 July to 7 September 1980. Other stations were sampled less regularly. Set times for these Swedish nets varied from 105 to 330 minutes but most sets were of 120 minutes duration.

Twelve inshore locations (Fig. 3) were sampled at weekly intervals from 20 July to 12 September 1980 using regular gillnets. These shore-based nets were 22.9 m long by 1.8 m deep and constructed of 210/4 braided nylon. Nets of 51 mm mesh size (bar measure) were used in most cases but 70 mm nets were used occasionally. Nets were tied to and run perpendicular to the shore, and were set in such a way that the float line remained at the water surface. Set times for these nets varied from 45 to 135 minutes.

Inshore areas were also sampled for small fish using seines with 6.4 mm mesh size. Four locations were sampled in 1979 using a seine 9.1 m long while a 6.1 m seine was employed at nine sites in 1980 (Fig. 3). In 1980 each seining site was sampled at weekly intervals from 7 July to 9 September. On each occasion two seine hauls were made at each site and the length of shoreline seined was recorded.

Treatment of samples in field

Most fish captured in gillnets were retained for life history analysis. The exceptions were fourhorn sculpin, Arctic flounder, and starry flounder which were often measured and released. In the case of seines the entire catch was usually retained for identification and analysis. A few times, however, when the catch was large, a representative subsample was retained and the remainder were returned to the water after their numbers had been estimated.

Retained fish were fixed in 10% formalin and transferred later to 40% isopropyl alcohol.

Laboratory techniques

Fish identification: Seine catches were identified using taxonomic keys and descriptions provided by Scott and Crossman (1973), McPhail and Lindsey (1970), Hart (1973), and McAllister (1960).

Life history analysis: Small fish that were captured in seines and preserved in formalin were measured to the nearest millimetre. No further analyses were performed on these fish. For fish captured in gillnets fork or total length (±1.0 mm) and body weight (usually ±25 g) were recorded and either scales or otoliths were retained for age determination. Sex and maturity were determined by gonadal examination. A fish was considered to be mature if it appeared that it would spawn or had already spawned in the year of capture. The degree of gonadal development was described according to the following scale:

Female	Male	
1	6	Immature
2	7	Maturing
3	8	Mature
4	9	Ripe
5	10	Spent
0		Sex Indistinguishable

Because the assignment of a maturity code is somewhat subjective, an attempt was made, in some cases, to quantify gonadal development by calculating the Gonadosomatic Index (GSI). Gonads were removed from these fish and weighed fresh to the nearest gram. The data on body and gonad weights were then used to determine the Gonadosomatic Index by the formula:

$$GSI = \frac{\text{Gonad Weight}}{\text{Fish Round Weight}} \times 100$$

Food habits were evaluated by a gross examination of stomach contents in the field. As well, a limited number of stomachs, which appeared to contain some food, were preserved in 10% formalin for further detailed analysis. The contents of these stomachs were later washed into a Petrie dish and the food items sorted by category and dried to constant weight at 38°C. The dried stomach contents were then weighed to the nearest 0.01 g. Results of the food habits analysis were expressed in terms of percentage frequency of occurrence and percentage of total dry weight. Inorganic material (stones, sand, etc.) were excluded from the weight calculations.

The scale method was used in determining ages for broad whitefish, lake whitefish, Arctic cisco, least cisco, and inconnu. Several scales from each fish were mounted between two glass slides and the annuli were interpreted from the image produced by a microprojector.

Otoliths were used in evaluating the ages of other fish species. These were treated in various ways, depending on the species. Otoliths from Pacific herring, rainbow smelt, and fourhorn sculpin were ground by hand on a carborundum and cleared using 100% glycerine. Those from Arctic flounder and starry flounder were cut with a jeweller's saw equipped with a No. 7 or No. 8 blade. The cut surface was then burned using an alcohol burner and the otolith cleared with cedarwood oil. Otoliths from burbot and saffron cod were embedded in epoxy resin and sectioned, growth zones being read from the cut surface with the aid of a dissecting microscope.

Data analysis

The relative abundance of various fish species was expressed in terms of absolute numbers, percentage composition, and catch-per-unit-effort. These data appear by gear type, sampling location, and date in Appendices 1, 2, 3, 4, and 5. Catch-per-unit-effort was expressed as the number of fish captured per net, per hour for both Swedish survey-type nets and regular gillnets. In the case of seines catch-per-unit-effort was expressed as the number of fish captured per 100 metres of shoreline seined.

Length, weight, and age data were analyzed for graphic and tabular presentation using a Hewlett-Packard Model 9810-A programmable calculator. Length-weight relationships were described by the power equation:

$$\log_{10}W = a + b\ (\log_{10}L);\ SD_b =$$

where W = weight (g)
L = fork or total length (mm)
a = y-intercept
b = slope of the regression line
SD_b = standard deviation of b

Relative condition factors (K) were determined from the formula:

$$K = \frac{W \times 10^5}{L^3}$$

RESULTS AND DISCUSSION

SEDIMENT TEXTURE

The bottom of Tuktoyaktuk Harbour appears to be covered with a thin layer of very finely divided sediments. At most locations (75%) the silt-clay fraction accounted for more than 94% of the sediment by weight, and only 11 stations had any material larger than fine sand (Table 1). The coarsest sediments with the smallest percentage of silt and clay were located at Sites TB2 and TB6 (Fig. 2). Both of these sites were shallow (2.0-2.5 m) and located on the main north-south axis of the harbour where they would be most exposed to wind action.

The organic content of the sediments varied from 3.86% at Site TB2 to 28.7% at Site TB8 but was between 7.5 and 14.0% at most (87.5%) locations (Table 2). Discrepancies between the two determinations at each station were usually slight (0.01-1.59%). The exception occurred in the sample from Site TB8 where a value of 40.83% was recorded in one case. The reason for this large discrepancy is not known. The relationship between particle size and organic content is apparent in the samples as those sites with the greatest percentage of sediments larger than very fine sand had the lowest organic content. At Sites TB2, TB6, TB7, TB10, and TB11, for example, organic content ranged from 3.86% to 9.14% whereas at the remaining stations (mostly silt-clay), the organic content was usually greater than 10%. Lawrence (unpublished data) found the organic content of the sediments in lakes of the Canyanek system on the Tuktoyaktuk Peninsula to range from 1 to 37% by weight.

BENTHIC MACROINVERTEBRATES

Benthic samples were taken from 24 locations in Tuktoyaktuk Harbour (Fig. 2); however, only 12 samples have been sorted to date, and identifications have been limited, for the most part, to major taxa (Table 3). Thirteen major invertebrate taxa were identified from Ekman grab samples with the Polychaeta being the most widespread and abundant group. Polychaeta occurred at 11 of the 12 sampling locations and accounted for 73.3% of the standing crop overall. They were most abundant at Sites TB13 and TB14 where 658 and 1244 individuals, respectively, were taken in single grab samples. Pelecypoda, which were taken at seven of the 12 sites, accounted for 11.9% of all animals identified but were abundant only at Sites TB7 and TB10. The substrate at these two sites was considerably sandier than at any of the other ten (Table 1).

More detailed studies of the invertebrate fauna in Beaufort Sea coastal areas have been conducted by Ellis (1960); Carey et al (1974); Kendel et al. (1975); Wacasey (1975); Griffiths et al. (1975, 1977); Jones and den Beste (1977) and Fallis et al. (in prep.).

FISH

Fifteen fish species, representing eight families, were identified from gillnet and seine catches during the present study (Table 4). Because of the large numbers of small least and Arctic cisco captured, small mesh seines produced the most fish, accounting for 63.8% of the total catch. Swedish gillnets contributed 21.8% of the catch while large mesh gillnets, fished mainly at nearshore locations, produced 14.4% of all fish captured (Table 5). Six anadromous species dominated the fish fauna, comprising 71.4% of the total catch in all gear types combined. Among the anadromous forms least cisco (43.8%) predominated, followed by Arctic cisco (26.8%), broad whitefish (13.7%), lake whitefish (7.6%), rainbow smelt (5.2%), and inconnu (2.7%). Another six species, accounting for 17.7% of the total catch, were considered to be brackish water or marine forms. Within this group fourhorn sculpin were by far the most abundant, making up 49.5% of the total. Other marine forms included starry flounder (19.1%), Pacific herring (16.1%), Arctic flounder (12.8%), saffron cod (2.4%), and eelpout (0.1%). The remaining three species, ninespine stickleback, pond smelt, and burbot are considered fresh water forms. Life history descriptions for the major fish species are presented below.

Broad whitefish

Distribution and relative abundance: The North American distribution of the broad whitefish extends from the Kuskokwim River system, Alaska (Alt 1976) to the Perry River, N.W.T. (Scott and Crossman 1973). It occurs in both fresh and brackish water but is seldom taken far offshore in the marine environment. Broad whitefish have been reported as far upstream as Fort Simpson in the Mackenzie River system (Stein et al. 1973) although they are most common in the lower reaches (Stein et al. 1973; Percy 1975; de Graaf and Machniak 1977). During the summer months broad whitefish are distributed along the Yukon coast (Kendel et al. 1975), through the outer Mackenzie Delta (Percy 1975), and along the coast of the Tuktoyaktuk Peninsula within the Mackenzie estuary (Galbraith and Hunter 1975; Jones and den Beste 1977; Lawrence et al. in prep.; Fallis et al. in prep.). Freshwater lakes in the Mackenzie Delta (Stein et al. 1973) and along the Tuktoyaktuk Peninsula (Lawrence et al. in prep.) are used extensively as summer feeding areas by this species. Broad whitefish have been harvested commercially only on a limited basis in the Mackenzie Delta, but constitute a major component of the domestic harvest in Delta communities including Tuktoyaktuk, Aklavik, and Arctic Red River (Fig. 1).

Broad whitefish made up only 9.8% overall of fish captured during the present study but they were common in nearshore areas throughout the summer, accounting for 53.0% of the total catch in shore-based gillnets (Table 5). The tendency for broad whitefish to remain inshore is emphasized by the fact that most of the 63 fish shown in Table 5 as having been captured in Swedish survey nets were also captured near shore. For example, of 41 fish taken by this gear in 1979, most were caught near the mouth of Mayogiak Creek (n=19) and in the mouth of Freshwater Creek (n=15). By contrast broad whitefish were never taken offshore in Kugmallit Bay and appeared to avoid the deep offshore waters within Tuktoyaktuk Harbour. Only seven broad whitefish were taken at the five survey net sites within the harbour during 1980. Two were captured at Site 3 while the remaining five were taken at Site 8, the shallowest of the five sites, located not far from the mouth of Mayogiak Creek (Fig. 3). Only 84 broad whitefish were captured in small mesh seines, accounting for just 2.0% of the total catch in that gear (Table 5). Most were caught in 1979 when good catches were made at Freshwater Creek (n=34), Aveltkok Inlet (n=15), and Mayogiak Creek (n=13). During 1980 only 19 broad whitefish were captured in seines, the majority (47%) at Freshwater Creek (Site S6) and Aveltkok Inlet (Site S15)(Appendix 4). These results suggest that Freshwater and Mayogiak creeks may serve as rearing areas for young broad whitefish.

Fallis et al. (in prep.) reported a large migration of broad whitefish, assumed to be Mackenzie River stock, in Kukjuktuk Creek, a small tributary draining a system of tundra lakes and entering the Beaufort Sea approximately 30 km northeast of Tuktoyaktuk (Fig. 1). The upstream migration began in mid-June while the Beaufort coast was still ice-covered, and peaked in late June and early July. These results suggest an early movement of broad whitefish from overwintering areas toward summer feeding locations with at least some of the migration passing Tuktoyaktuk under ice in late May or early June.

Broad whitefish were present in Tuktoyaktuk Harbour at the beginning of July, 1980 and were being harvested by the domestic fishery at the west harbour entrance immediately after ice-out. They were captured at all inshore sites except Site 23 on 20-22 July but were abundant only at Sites 33, 29, and 21 at that time. During the remainder of the summer the catch-per-unit-effort in shore-based gillnets varied considerably (Fig. 4) indicating continuous migratory activity. It is likely that for much of the summer the catch included fish moving in both directions along the coast. The large abundance peak observed in early September, however, is believed to represent a concerted westward movement toward overwintering areas near the mouth of the Mackenzie River. Our sampling program extended only until 12 September; however, local residents tell us that few whitefish are to be captured in the harbour after September.

Although seines captured few broad whitefish the results seem to indicate migratory behaviour on the part of small fish as well (Fig. 4). The peak in mid-July and the subsequent decrease in catch-per-unit-effort is consistent with the observations of Fallis et al. (in prep.) who reported that, by late July, most upstream migrants in Kukjuktuk Creek were young-of-the-year and yearlings. The fact that small broad whitefish did not reappear in the seine catches in mid-September lends support to their suggestion that small broad whitefish overwinter in some freshwater lakes on the Tuktoyaktuk Peninsula. On the other hand, several small broad whitefish (41-91 mm) were captured in seines on 26 September 1979 at Mayogiak Creek (n=6), Freshwater Creek (n=1), and Aveltok Inlet (n=2) (Appendix 5).

Age and growth: Broad whitefish from Tuktoyaktuk Harbour ranged from 34 to 530 mm in fork length with those between 350 and 474 mm comprising 80% of the total sample. Most broad whitefish captured during the study (77.8%) were taken in large mesh gillnets set at inshore locations and the overall length-frequency distribution reflects the selective nature of this gear (Fig. 5). Variable mesh Swedish survey nets captured broad whitefish over a larger size range (90-461 mm) but these nets were seldom fished inshore in 1980. Figure 5 suggests that broad whitefish less than 350 mm may have been more abundant at inshore locations than the 1980 data indicate.

The length-frequency distribution observed in the present study is similar to that reported by Jones and den Beste (1977) at Tuft Point. Broad whitefish found along the coast of the Tuktoyaktuk Peninsula appear to be smaller, on the average, than those captured in the Mackenzie River. Stein et al. (1973) and Percy (1975) reported that most broad whitefish in their catches were between 431 and 540 mm. Chang-Kue and Jessop (in prep.), fishing in the east channel concurrently with the present study, found the majority of broad whitefish to be between 425 and 550 mm in fork length. No difference was observed between the length-frequency distribution for male and female broad whitefish from Tuktoyaktuk Harbour except during 1979 when the sample size was small (Fig. 5).

Broad whitefish from Tuktoyaktuk Harbour ranged up to 13 years in scale age although the majority (73%) were age 7 to 10 inclusive (Table 6). Percy (1975) and Stein et al. (1973) both reported a maximum scale age of 15 years for Mackenzie River broad whitefish while de Graaf and Machniak (1977) indicated a maximum otolith-based age of 19 years.

Broad whitefish increased in fork length at a rapid rate up to age 4 by which age a mean length of 330 mm was achieved (Table 6). Beyond age 4 length increased at a slower rate. No significant difference was observed between the growth rates for male and female fish (Table 6). De Graaf and Machniak (1977) also found male and female broad whitefish to grow at equal rates.

The growth rate for broad whitefish at Tuktoyaktuk is intermediate between rates reported from the Mackenzie River (Hatfield et al. 1972; de Graaf and Machniak 1977) and Kukjuktuk Creek (Fallis et al. in prep.), but considerably faster than indicated by Muth (1969) for Coppermine River fish (Fig. 6). Berg (1962-65) indicated that growth of broad whitefish can vary considerably between drainage systems. However, with the exception of the data for the Coppermine River, all growth curves in Fig. 6 are assumed to have been derived from fish belonging to the Mackenzie River population. The apparent differences in growth rate may be related to the fact that different authors derived their curves from different segments of the population (e.g. mature vs immature fish), or to differences in techniques related to age determination.

The mathematical relationship between fork length and body weight for male broad whitefish from Tuktoyaktuk Harbour (n=306, range 282-530 mm) is described by the equation:

$$\log_{10} W = 3.325 (\log_{10} L) - 5.701; SD_b = 0.030$$

The equivalent relationship for females (n=255, range 262-524 mm) is described by the equation:

$$\log_{10} W = 3.297 (\log_{10} L) - 5.626; SD_b = 0.047$$

Analysis of covariance indicated no significant difference ($P>0.05$) between the adjusted means ($F=0.138$, 558 df) or slopes ($F=0.265$, 557 df) of the length-weight regressions for males and females.

Sex ratio and maturity: Of 510 fish examined only 5.5% were judged capable of spawning in 1980. Similarly, Jones and den Beste (1977), Galbraith and Hunter (1975), and Fallis et al. (in prep.) reported few mature individuals among broad whitefish captured along the coast of the

Tuktoyaktuk Peninsula. The youngest mature male examined during the present study was age 8 while the youngest mature female was age 7 (Table 7). De Graaf and Machniak (1977) reported a minimum age of maturity of 7 years in the Mackenzie River while Kogl (1972) found that broad whitefish first spawned at age 7 or 8 in the Colville River, Alaska. Percy (1975) reported sexually mature broad whitefish as young as 3 or 4 years. Small numbers of broad whitefish captured at Tuktoyaktuk showed evidence of having spawned previously but would not spawn in 1980; thus, some broad whitefish do not spawn every year.

As mentioned previously only 5.5% of broad whitefish were identified as possible 1980 spawners. This included 8.0% of the females but only 3.3% of the males examined. The use of the gonadosomatic index (GSI) indicated that, in the case of females, the judgement as to whether or not a fish would spawn in the ensuing spawning season could be made very reliably. When GSI is plotted against fork length, the points fall into two distinct clusters (Fig. 7), one in which the GSI lies generally in the range of 0.4 to 0.6 and another in which the range is approximately 5 to 10. The clusters are separated, therefore, by an order of magnitude during the period July to September. The former cluster consisted largely of virgin non-spawners (maturity category 1) while the latter group included fish that would spawn in 1980 (maturity category 3). Two previous spawners (captured 11 August) which would not spawn in 1980 had GSI values of 0.8 and 0.9. The mean egg diameter for three mature females captured between 11 and 18 August (GSI's of 8.4 to 9.5) was 1.6 mm.

Males are often more difficult than females for the field worker to categorize as to state of sexual maturity and, when doubt exists, fish are generally placed in category 7. Figure 8 indicates that this problem can be largely overcome by the use of the GSI. Fish that would definitely not spawn in 1980 generally showed a GSI of close to 0.1 and were separated from spawners (as was the case with females) by an order of magnitude difference in the GSI. Between these two groups lie a number of fish with intermediate GSI values whose true status is more difficult to assess and which are properly placed in category 7. Unfortunately, it is clear that during the present study, some fish with GSI's near 1.0 were placed in category 7 when they perhaps should more properly have been placed in category 8. Thus, had a quantitative method of assigning a maturity code been used, the percentage of males judged capable of spawning in 1980 would have been higher than the 3.3% reported above.

Figures 7 and 8 also suggest that sexual maturity in broad whitefish is first achieved at a fork length of approximately 420 to 450 mm. Table 6 indicates that fish of that size could be as young as age 5 but are more likely to be age 7 to 9.

Except for age 9, where males outnumbered females, no significant difference (P>0.05) occurred between the number of males and females, either within age groups or in the overall sample (Table 7) although males (54%) did outnumber females. Stein et al. (1973), Percy (1975), and de Graaf and Machniak (1977) all reported female broad whitefish outnumbering the males but that the sex ratio did not differ significantly from unity.

Spawning: The small number of mature fish captured during the present study suggests that broad whitefish do not spawn in the vicinity of Tuktoyaktuk Harbour. The major spawning areas for this species are known to occur in the Mackenzie River or its tributaries. Percy (1975) reported increasing numbers of mature broad whitefish in the outer Mackenzie Delta during early summer, the migration having passed upstream of the outer delta by the end of July. Stein et al. (1973) reported spawning at the mouth of the Arctic Red River in late October with a post-spawning, downstream migration to overwintering areas occurring during the first two weeks of November. Other spawning sites probably also exist in the Mackenzie River downstream of Arctic Red River (Percy 1975). Nikolski and Reshetnikov (1970) believe that current is a prerequisite for gonad ripening in broad whitefish.

Food habits: The stomachs of broad whitefish captured in Tuktoyaktuk Harbour seldom contained food and those that did usually contained only small amounts. Of 560 stomachs examined, 88% were empty. Other authors also report a high incidence of empty stomachs among broad whitefish captured in the Mackenzie River (Stein et al. 1973; Percy 1975) and in coastal waters (Jones and den Beste 1977; Lawrence et al. in prep.). On the other hand, broad whitefish captured in lakes, both in the Mackenzie Delta (Stein et al. 1973; de Graaf and Machniak 1977) and along the Tuktoyaktuk Peninsula (Lawrence et al. in prep.) have had fewer empty stomachs and contained greater quantities of food. These lakes appear to be important summer feeding areas for broad whitefish. Nikolski (1961) reported that broad whitefish in Siberia usually feed in lakes connected with river channels.

Laboratory analysis of 59 broad whitefish stomachs (Table 8) showed that plant remains occurred in 73% of those stomachs that contained food, comprising 23% of the total dry weight biomass. Chironomidae (59%) and Pelecypoda (43%) were also common in terms of frequency of occurrence although Gastopoda contributed a larger percentage of the total food biomass (26%). Other food items included Trichoptera and other insect remains, Amphipoda, Mysidacea, Isopoda, Copepoda, Ostracoda, Conchostraca, Notostraca, Oligochaeta, Acarina, and Priapulida. Lawrence et al. (in prep.) reported that the diet of broad whitefish captured in freshwater lake systems draining into the Beaufort Sea from Richard's Island and the Tuktoyaktuk Peninsula was dominated by Gastropoda, Pelecypoda, Chironomidae, Notostraca, and Amphipoda.

Overwintering: During the present study only three broad whitefish were captured under ice, two at Site 3 on 12 June 1980 and one at Site 13 on 20 March 1981. Winter fishing, however, was conducted offshore in deep water where few broad whitefish occur even in summer and, therefore, the possibility that broad whitefish may overwinter in the fresh upper waters cannot be ruled out. Local residents report, however, that whitefish leave Tuktoyaktuk Harbour in September to overwinter in lakes. Some overwintering lakes on the Tuktoyaktuk Pensinsula have been identified by Lawrence et al. (in prep.) and large numbers of small broad whitefish are suspected of overwintering in freshwater lakes of the Kukjuktuk system (Fallis et al. in prep.). Mann (1975) and Percy (1975) reported capturing broad whitefish during winter surveys in the outer Mackenzie Delta while Jessop and Lilley (1975) captured overwintering whitefish in several lakes in the inner delta. Percy (1975) concluded that the inshore zone of the outer Mackenzie River Delta is an important overwintering area for broad whitefish.

Lake whitefish

Distribution and relative abundance: Lake whitefish occur in lakes and rivers throughout Canada and Alaska. In the Mackenzie Delta - Beaufort Sea area the species is semi-anadromous, venturing into nearshore coastal waters during the summer months. Lake whitefish have been taken as far west of the Delta as Roland Bay on the Yukon coast by Kendel et al. (1975) who believed that these fish returned to the Mackenzie River to spawn and overwinter. Decreasing abundance as one moves eastward away from the Mackenzie River (Galbraith and Hunter 1975; Lawrence et al. in prep.) as well as tag return evidence (Fallis et al. in prep.) suggests that lake whitefish captured in nearshore areas along the Tuktoyaktuk Peninsula are also of Mackenzie River stock. Lake whitefish comprise a large portion of domestic fishery catches throughout the Mackenzie River Valley (Hatfield et al. 1972).

Lake whitefish made up 5.4% of all fish captured in Tuktoyaktuk Harbour during the present study. While small numbers were captured offshore in Kugmallit Bay under ice (n=4), lake whitefish were more common in nearshore areas during the summer, contributing 14.2% of the catch in shore-based gillnets (Table 5). The largest catches in these nets were made in the northern portion of the harbour with 67% of the total catch being taken at Sites 25, 29, 30, 31, and 33 (Fig. 3). Most of the lake whitefish taken in Swedish survey nets were also captured at inshore locations. During 1980 only 26 lake whitefish were captured at the five survey net sites within the harbour (Fig. 3). Of this number, 13 (50%) were taken at Site 8, a relatively shallow location, not far from the mouth of Mayogiak Creek. As with broad whitefish, therefore, lake whitefish appear to avoid the deep, offshore waters within Tuk Harbour. Seines took only nine lake whitefish during 1980; however, good catches made at the mouth of Freshwater Creek (n=42) and Mayogiak Creek (n=52) in 1979 (Appendix 5) suggest that these streams may serve as rearing areas for lake whitefish. Overall, lake whitefish accounted for 2.9% of all fish captured in seines during the study (Table 5).

Lake whitefish were captured in Swedish survey nets throughout the year but, as mentioned previously, were only captured in quantity by this gear at Site 8. When the catch-per-unit-effort data for all five survey net sites in the harbour are combined (Fig. 9) no obvious trend is apparent. However, the catch-per-unit-effort was generally high at Site 8 from late May to early August, dropping rapidly after 2-4 August. None was taken at Site 8 on 19 August or in September (Appendix 1). It appears, then, that lake whitefish left the vicinity of Mayogiak Creek by early to mid-August. This is consistent with the results of Fallis et al. (in prep.) who reported a downstream migration of lake whitefish out of Kukjuktuk Creek in late July and early August. The decrease in the abundance of lake whitefish evidenced at Site 8 coincides with a mid-August increase in the catch-per-unit-effort values observed for this species in shore-based gillnets (Fig. 9, Appendix 3). The pattern of catch-per-unit-effort for lake whitefish in these nets is very similar to that reported earlier for broad whitefish (Fig. 4). That is, a small peak in mid-August, followed by a slight decrease and then a rapid increase to a large abundance peak in September. From the results of Fallis et al. (in prep.) a similar explanation is probably in order. Lake whitefish may have moved undetected under ice in late spring to reach feeding areas along the coast of the Tuktoyaktuk Peninsula by mid-June. Fluctuating catch-per-unit-effort values suggest a continuation of coastal migrations throughout the summer with a return migration to overwintering areas peaking in September at Tuktoyaktuk.

Although they are found in coastal areas throughout the summer small lake whitefish are seldom taken in abundance, and apparently do not undertake summer coastal migrations to the same extent as do young Arctic cisco and least cisco. (Lawrence et al. in prep.). Only 125 small lake whitefish were captured in seines during the present study, most of them in the mouths of Mayogiak and Freshwater creeks. In both years the catch-per-unit-effort was highest near the end of August and dropped to zero in September (Appendices 4 and 5, Fig. 9) suggesting a migration out of Tuk Harbour at that time.

Age and growth: Although lake whitefish ranged from 48 to 485 mm in fork length, gear selectivity was an important factor in determining the length-frequency distribution (Fig. 10). Shore-based gillnets (mostly 51 mm bar measure) captured lake whitefish between 314 and 485 mm with the majority (78%) in the 350 to 424 mm range. These nets took only 18 fish smaller than 350 mm. Swedish nets captured lake whitefish in the 98 to 417 mm length range although most fish captured in this gear (78%) were between 150 and 299 mm. The size range for lake whitefish in Tuktoyaktuk Harbour is similar to that reported by other studies in the area (de Graaf and Machniak 1977; Jones and den Beste 1977; Stein et al. 1973; Percy 1975). There was no difference between the length-frequency distributions for male and female lake whitefish in the 1980 sample (Fig. 10). Such differences occurring in the 1979 sample are thought simply to be artifacts arising from the small sample size.

The maximum scale age for lake whitefish captured in Tuktoyaktuk Harbour during the present study was 16 years although most fish (88%) were between 3 and 13 years (Table 9). Fish taken in Swedish nets were mainly age 3 to 6 while most of those captured in shore-based large mesh nets were between age 9 and 13. Because few age 0 to 6 fish were captured in 1980, 1979 and 1980 data have been combined for these age classes in Table 9 in order to fill in the lower part of the growth curve. The 1979 data are presented separately in Appendix 6. Percy (1975) reported a maximum scale age of 18 years for lake whitefish in the Mackenzie River while de Graaf and Machniak (1977) reported an otolith-based age of 20 years.

The growth rate of lake whitefish varies greatly across their geographic range. Whitefish from Tuktoyaktuk Harbour are among the slowest growing reported within the Northwest Territories (Healey 1975) but their growth rate is similar to that reported by Alt (1979a) for Alaskan coastal waters, de Graaf and Machniak (1977) for the Mackenzie River, and Fallis et al. (in prep.) for Kukjuktuk Creek (Fig. 11). No significant difference was observed between the growth rates of male and female fish (Table 9). Similarly, de Graaf and Machniak (1977) reported no significant differences in mean fork length between male and female lake whitefish within age groups.

The mathematical relationship between fork length and body weight for male lake whitefish from Tuktoyaktuk Harbour (n=104, range 155-440 mm) is described by the equation:

$$\log_{10}W = 3.421\ (\log_{10}L) - 5.938;\ SD_b = 0.037$$

The length-weight relationship for female lake whitefish (n=91, range 155-476 mm) is described by the equation:

$$\log_{10}W = 3.428\ (\log_{10}L) - 5.950;\ SD_b = 0.039$$

Analysis of covariance indicated no significant difference (P>0.05) between the adjusted means (F=0.894; 192 df) or slopes (F=0.016, df=191) of the length-weight regressions for males and females.

Sex ratio and maturity: Other authors (Jones and den Beste 1977; Galbraith and Hunter 1975; Fallis et al. in prep.) have reported very few mature lake whitefish in catches made along the coast of the Tuktoyaktuk Peninsula. In Tuktoyaktuk Harbour this also proved to be the case as only 5.3% of 190 fish examined in the field were judged capable of spawning in the year of capture. The youngest mature male and female examined during the study were 8 and 10 years old respectively (Table 10). This is in agreement with the results of other studies that indicate that lake whitefish in this region generally mature between age 7 and age 11 (Stein et al. 1973; Alt and Kogl 1973; Percy 1975; Kendel et al. 1975; de Graaf and Machniak 1977).

As was the case with broad whitefish, calculation of the gonadosomatic index (GSI) for lake whitefish suggests that subjective evaluations of maturity state in the field tend to underestimate the number of mature fish, at least in the case of males. During the present study the GSI was calculated for 25 females (range 344 to 459 mm) and 28 males (range 323 to 440 mm). The GSI for mature females (n=9) ranged from 3.3 to 12.4 with a mean value of 6.1. The fish with the largest GSI (12.4) was caught on 4 September 1980 and had a mean egg diameter of 1.9 mm. The GSI for non-spawning females (n=16) varied from 0.3 to 1.2 with a mean of 0.7. At least one non-virgin female was observed, indicating that some lake whitefish do not spawn every year in this area. Most male whitefish examined had a GSI close to 0.1 and such fish were considered to be non-spawners (n=21). Males (n=7) with GSI values between 0.9 and 1.7 (mean=1.4) were expected to spawn in the current year. One male, 420 mm in fork length, captured on 18 August 1980 had tubercles beginning to form and a GSI value of 1.7.

Male and female lake whitefish occurred in approximately equal numbers in each age group, and in the overall sample the sex ratio did not differ significantly (P>0.05) from unity (Table 10).

Spawning: The large abundance peak for lake whitefish which occurred in September (Fig. 9) consisted almost entirely of non-spawning fish and all indications suggest that whitefish do not spawn in the vicinity of Tuktoyaktuk Harbour. Lake whitefish are reported to spawn in the Mackenzie River near Arctic Red River during October (Stein et al. 1973; Jessop and Lilley 1975).

Food habits: The stomachs of lake whitefish from Tuktoyaktuk Harbour contained little food and, of 212 examined, 144 (68%) were empty. The stomachs of 68 fish examined in the laboratory (Table 11) contained mostly unidentifiable remains, plant remains, and fish remains, these three categories accounting for 74% of the total dry weight biomass. Among identifiable food items Pelecypoda, Amphipoda, and Mysidacea were the most important.

Kendel et al. (1975) suggested that coastal bays and lagoons were important feeding areas for lake whitefish along the Yukon coast. Fish captured in embayments along the Kugmallit Bay coast west of Tuktoyaktuk had fed primarily on Isopoda which occurred in 63% of the stomachs examined and made up 75% of the total dry weight of the stomach contents (Lawrence et al. in prep.).

By contrast, several studies have provided evidence that the major summer feeding areas for lake whitefish in this area are located in lakes, both within the Mackenzie Delta (Stein et al. 1973; Percy 1975) and along the Tuktoyaktuk Peninsula (Lawrence et al. in prep.). That lake whitefish undertake feeding migrations from coastal waters into tundra lakes during the summer has been demonstrated by Fallis et al. (in prep.) who reported an upstream run of 6575 fish in Kukjuktuk Creek.

The high incidence of empty stomachs observed during the present study and the general paucity of food in those stomachs that contained food suggest that lake whitefish captured in Tuktoyaktuk Harbour were in the process of migration, and that little feeding occurred within the harbour itself.

Overwintering: Lake whitefish were captured under ice in the vicinity of Tuktoyaktuk during

April, 1980 (n=3), May, 1980 (n=6), June, 1980 (n=3), January, 1981 (n=1), and March, 1981 (n=6) (Appendix 1). These figures indicate that some lake whitefish do overwinter in Tuktoyaktuk Harbour and in Kugmallit Bay. Overwintering lake whitefish have also been taken in the outer Mackenzie Delta (Percy 1975), and in Delta channels (Mann 1975). Fallis et al. (in prep.) caught 3000 more lake whitefish in the downstream run than in the upstream migration at Kukjuktuk Creek, suggesting that freshwater lakes along the Tuktoyaktuk Peninsula also serve as overwintering areas for this species.

Arctic cisco

Distribution and relative abundance: In North America Arctic cisco are found along the Arctic coast from Point Barrow, Alaska to Bathurst Inlet (Scott and Crossman 1973). They occupy a wide variety of coastal inshore habitats (Craig and Mann 1974; Craig and Griffiths 1978; Griffiths et al. 1975, 1977; Percy 1975; Galbraith and Hunter 1975; Bray 1975; Jones and den Beste 1977; Lawrence et al. in prep.), but, except for purposes of spawning and, perhaps, overwintering, seldom enter fresh water (Craig and Mann 1974; Percy 1975; Lawrence et al. in prep.). On the other hand they appear to be more tolerant of high salinities and venture further offshore than most other coregonid species (Galbraith and Hunter 1975). Despite their widespread distribution along the Beaufort Sea coast Craig and Mann (1974) believe that Arctic cisco in this area utilize only the Colville and Mackenzie rivers for spawning and overwintering, and that, therefore, all Arctic cisco on the Beaufort coast originate from these two watersheds. Spawning runs into the Mackenzie River are known to extend as far inland as British Columbian reaches of the Liard River (Dr. S.M. Hirst, B.C. Hydro, personal communication, 10 February 1981). During their spawning migration they are harvested in large numbers by domestic fisheries throughout the Mackenzie River valley.

Arctic cisco was the second most abundant species captured during the present study, comprising 19.2% of the total combined catch (Table 5). Most of those captured (81.4%) were taken in small mesh seines, this species accounting for 24.6% of the total catch in that gear. The largest seine catches of small Arctic cisco were made at Sites S4, S6, S15, and S5 (Fig. 3, Appendix 4). Swedish gillnets captured Arctic cisco offshore in Kugmallit Bay and at both inshore and offshore locations within Tuktoyaktuk Harbour. Ciscoes comprised 13.7% of the catch in Swedish nets, but only 4.1% of that in shore-based 51 mm gillnets which were highly selective for fish larger than 375 mm fork length. During the period 12 April to 13 June 1980, Arctic cisco made up 34.6% of all fish taken at the five survey net sites within Tuktoyaktuk Harbour with most specimens (60.6%) being captured at Site 7.

Catch-per-unit-effort values produced by Swedish gillnets (Fig. 12, Appendix 1) indicate that Arctic cisco were present in abundance under ice cover in the deeper waters of Tuktoyaktuk Harbour. By mid-July, shortly after ice-out, catch-per-unit-effort had dropped sharply, indicating a migration out of the harbour. Few Arctic cisco were captured in gillnets between mid-July and the end of August, but early in September a large migration back into the Harbour was reflected in rapidly increasing catch-per-unit-effort values both in Swedish nets and in shore-based gillnets (Fig. 12). The largest catches at that time (6-7 September) were made at Site 8 (n=30), Site 6 (n=14), and Site 3 (n=12) while no fish were captured at Site 7. These results suggest that the September in-migration was coming from the east and entering the harbour through the eastern entrance. The in-migration continued throughout September and, by 25 September, Arctic cisco were present virtually everywhere in the harbour. S. Byers (Dobrocky Seatech Ltd., Personal Communication, 27 November 1980) reports that Swedish survey nets set in the west harbour entrance on 25 September (just south of Site 7) captured 29 Arctic cisco in a one hour surface set and 39 in a one hour bottom set. Ms Byers also indicated that Arctic cisco were abundant up to about 200 m offshore in Kugmallit Bay at that time. The "winter" domestic fishery began after freeze-up in early October with most of the fishing effort concentrated along the west shore of the western harbour entrance (Mr D. Wilson, Personal Communication, 6 November 1980). Mr Wilson reports that there were 100 to 150 nets in the water at this time, most of which were 38 to 51 mm bar measure and approximately 10 to 15 m long. A net count on 12 October showed up to 50 Arctic cisco being captured in a single 15 m net.

Young-of-the-year Arctic cisco were present in Tuktoyaktuk Harbour by 10 July but the catch-per-unit-effort decreased rapidly after 18 July suggesting a dispersal to rearing areas located along the coast of the Tuktoyaktuk Peninsula. Relatively small numbers of small ciscoes were captured in the harbour from late July through early September (Fig. 12). A dredge-monitoring program conducted in Tuktoyaktuk Harbour during October and November 1980 (Pelletier and Wilson 1981) produced several young-of-the-year Arctic cisco indicating the presence of these small fish in the Harbour under ice-cover.

Age and growth: Arctic cisco from Tuktoyaktuk Harbour ranged in fork length from 26 to 480 mm with fish less than 100 mm comprising the vast majority (>80%). The length-frequency distribution varied greatly with gear type and throughout the year, reflecting the selective nature of the gear, growth of smaller fish, and seasonal movements of larger individuals.

The length-frequency distribution for Arctic cisco captured in gillnets is presented in Fig. 13. Fish taken in 51 mm shore-based nets (n=39) ranged from 353 to 430 mm with the majority (87%) being between 375 and 424 mm. Swedish gillnets, on the other hand, captured Arctic cisco between 95 and 480 mm (n=181). Two major modes occurred in the length-frequency distribution of Arctic cisco captured in this gear. The first, occurring between 175 and 224 mm, contained approximately 24% of the total catch while 50% of the fish fell in the 275 to 374 mm size range. Among fish captured in all gillnets (Fig. 13), females, with a modal length in the 375 to 399 mm interval, were clearly larger than males whose modal fork length was between 275 and 349 mm. This discrepancy appears to have been accentuated by the 51 mm nets, which captured mainly females (74%). The difference in length-frequency distribution for the two sexes is less pronounced when the results from Swedish nets are considered separately although, even then, 69% of all fish larger than 350 mm fork length were females.

The mean length of fish captured in Swedish gillnets varied throughout the sampling period, probably reflecting the pattern of movement of fish out of and into the study area. As indicated in Table 12, Arctic cisco captured under ice between 15 April and 1 June had a mean fork length of 305 mm. During June and July, the mean fork length decreased as large ciscoes led the migration out of the harbour. The large migration back into the harbour in September was apparently led by the smaller fish as mean fork length increased from 194 mm on 4 September (Byers and Kashino 1980), to 256 mm on 6-7 September, and to 316 mm on 25 September (Byers and Kashino 1980).

Small mesh seines, for the most part, captured Arctic cisco less than 125 mm in length. Most of the fish taken in this gear were young-of-the-year with smaller numbers of yearlings accounting for the second mode in Fig. 14. The shift in length- frequency distribution over the summer probably reflects the growth in length of fish in these age groups.

Arctic cisco captured during the present study ranged in age from 0 to 11 years. Young-of-the-year (age 0) were by far the most abundant age group. As mentioned previously these young fish were most numerous in the harbour in mid-July but abundance decreased through the summer as their dispersal proceeded. Young-of-the-year, which probably emerged in the spring from spawning sites in the Mackenzie River and its tributaries, had achieved a mean fork length of 35 mm by 10 July and grew rapidly during the summer. A sample obtained in October-November, 1980 (Pelletier and Wilson 1981) showed young-of-the-year to range from 64 to 95 mm with a mean of 78 mm. Age 1 fish captured in mid-July (Table 13) had a mean fork length of 94 mm.

The maximum scale age recorded for Arctic cisco in Tuktoyaktuk Harbour was 11 years although most fish (93%) were age 3 to 9 inclusive with age 3 (n=28), age 7 (n=30), and age 8 (n=37) being most common (Table 13). This age distribution is similar to that reported by Jones and den Beste (1977) at Tuft Point on the Tuk Peninsula. Craig and Mann (1974) reported a maximum scale age of 14 years for Arctic cisco but a maximum otolith-based age of 21 years. They observed that scale and otolith ages agreed closely through age 10 but that scales tended to underestimate age among older fish.

Arctic cisco from Tuktoyaktuk Harbour grew at a rapid, almost constant rate through age 7, by which age a mean fork length of 356 mm was achieved (Table 13). Beyond age 7 little increase in length occurred. Females were generally larger than males from age 6 on but the difference between the sexes was significant ($P<0.01$) only at age 7 (Table 13). Craig and Mann (1974) also failed to detect a difference in growth rate between male and female Arctic cisco along the Yukon coast; however, Griffiths et al. (1975, 1977) reported a tendency for females to be larger than males in the older age groups.

A comparison of growth rates (Fig. 15) showed the growth rate for Arctic cisco from Tuktoyaktuk Harbour to be similar to that reported by most other authors. Galbraith and Hunter (1975), however, reported a much slower growth rate for this species, possibly as a result of differences in aging techniques.

The mathematical relationship between fork length and body weight for male Arctic cisco captured in Tuktoyaktuk Harbour during the present study (n=71, range 184-402 mm) is described by the equation:

$$\log_{10}W = 3.025\ (\log_{10}L) - 5.010;\ SD_b = 0.102$$

The equivalent expression for female Arctic cisco (n=126, range 154-480 mm) is described by the equation:

$$\log_{10}W = 3.364\ (\log_{10}L) - 5.855;\ SD_b = 0.038$$

Analysis of covariance indicated a significant difference ($P<0.01$) between the slopes ($F=13.442$; 193 df) but not between the adjusted means ($P>0.05$; $F=0.097$; 194 df) of the length-weight regressions for male and female ciscoes.

Sex ratio and maturity: Female Arctic cisco outnumbered males in virtually every age group (Table 14) and the overall sex ratio was significantly different ($X^2=13.23$; $P<0.01$) from unity as females comprised 64% of the total sample. Within age groups, however, a significant difference from a 1:1 ratio was observed only at age 9 ($X^2=10.32$; $P<0.01$). Sex ratios reported for this species in North America vary greatly. Kogl and Schell (1974), Hatfield et al. (1972), and Stein et al. (1973) reported no significant difference between the numbers of males and females. Males were significantly more abundant than females among Arctic cisco taken by Craig and Mann (1974) and Griffiths et al. (1975) on the Yukon coast, by Griffiths et al. (1977) on the Alaskan coast, by Percy (1975) in the outer Mackenzie Delta, and by Jones and den Beste (1977) at Tuft Point on the Tuktoyaktuk Peninsula. Craig and Mann (1974) and Roguski and Komarek (1972), however, both reported significantly more females in samples from Alaskan coastal waters. The wide variation in observed sex ratios suggests that male and female Arctic cisco may differ in their coastal migration patterns, moving and occupying different locations at different times of the year.

Craig and Griffiths (1978) suggested that mature Arctic cisco (those that will spawn in the current season) leave overwintering areas in the Colville River Delta in early spring, undertake a brief migration into coastal waters, and return to the spawning stream by mid-July. Their disappearance from coastal areas leaves this habitat occupied by juveniles and mature non-spawners throughout the summer. Certainly most studies along the Beaufort Sea coast have reported few mature Arctic cisco during the summer months (Griffiths et al. 1975, 1977; Galbraith and Hunter 1975; Jones and den Beste 1977; Lawrence et al. in prep.). During the present study 23% of females but only 4% of male Arctic cisco were judged capable of spawning during the current year (Table 14). Most of these spawners were captured between 1 July and 22 July and only two were taken later than 7 August. The large September movements noted previously involved non-spawning fish. The large spawners captured at Tuktoyaktuk in June and early July could have represented a short early season migration away from overwintering areas in the Mackenzie Delta. It is more probable, however, that these were fish that had overwintered in Tuktoyaktuk Harbour and were now proceeding toward the Mackenzie River to spawn.

As with other coregonids subjective field observations may tend to underestimate the numbers of mature male Arctic cisco. It is possible that most of the males, captured in May, June, and July and assigned to maturity category 7 (n=8) should have been placed in category 8. Unfortunately we did not acquire sufficient quantitative information on gonad size to substantiate this. Gonadosmatic indices for five male Arctic cisco (377-402 mm) captured on 21-22 July ranged from 0.7 to 1.2 with a mean value of 0.9. Four of these fish had been placed in category 7, while the other (GSI=1.2) was considered a spawner. A single male (400 mm) captured on 10 September had a GSI value of 0.5 and would not have spawned in 1980. The GSI was determined for 19 female Arctic cisco (353-430 mm) captured between 21 July and 7 August. Most of these fish had egg diameters of approximately 1 mm. Seventeen of the females had GSI values in the range 2.5 to 10.3 with a mean value of 5.6 and were considered mature fish. The other two had GSI's of 0.9 and 1.5 and were not believed to be capable of spawning during the current year.

The youngest mature male Arctic cisco captured during the present study was age 8 while the youngest mature female was age 6 (Table 14). A minimum age of maturity of 5 years has been reported by Kendel et al. (1975) but most authors agree that Arctic cisco generally mature between age 6 and age 10 (Griffiths et al. 1975, 1977; Stein et al. 1973; Jones and den Beste 1977). Craig and Griffiths (1978) report that males tend to reach maturity a year earlier than females.

Spawning: Arctic cisco commence their spawning migration into the Mackenzie River in late June and July and have passed the outer delta by mid-August (Percy 1975). Spawning occurs in the Peel, Arctic Red, Great Bear, and Liard rivers in late September and October, followed by a downstream run of spent fish to overwintering areas. Craig and Mann (1974) and Kendel et al. (1975) believe that Arctic cisco found along the Yukon coast represent Mackenzie stock which, upon reaching sexual maturity, will spawn in that system. We believe that the same is true for Arctic cisco captured in Tuktoyaktuk Harbour.

Food habits: A total of 199 Arctic cisco stomachs were examined during the present study of which 132 (66%) were empty. Laboratory examination of 96 stomachs (Table 15) indicated a diet dominated by Polychaeta which occurred in 30% of all stomachs containing food and accounted for 51% of the total dry weight biomass. Thirty-two of the 67 fish containing food were captured under ice at Site 7 (Fig. 3) between 15 April and 13 June 1980. Among these fish Polychaeta had a frequency of occurrence of 41% and made up 85% of the food in terms of dry weight biomass. Apart from Polychaeta, Crustacea, especially Amphipoda and Copepoda, were the most important items in the diet. Other food items included Mollusca (clams and snails), Hydrozoa, fish and fish eggs, plant remains, and Foraminifera.

Arctic cisco are opportunistic feeders with a varied diet. Along the Arctic coast, however, most studies agree that Crustacea, especially Amphipoda, Copepoda, and Mysidacea, are the dominant food items during the summer months (Kendel et al. 1975; Jones and den Beste 1977; Craig and Mann 1974; Griffiths et al. 1975, 1977). At Tuk Harbour Crustacea were also found to be important in the diet but since the fish left the harbour during the summer, our sample consisted largely of overwintering fish. Arctic cisco in Tuk Harbour depended on Polychaeta to a far greater extent than reported in other studies. It is possible, however, that the diet of these fish changes when they leave the harbour.

The percentage of empty stomachs found in Arctic cisco during the present study was 66% overall, but there were more empty stomachs in fish taken during the open water period (85%) than during the winter (32%). The highest incidence of empty stomachs in Arctic cisco (87-97%) is reported to occur during spawning migrations in the Mackenzie River (de Graaf and Machniak 1977; Percy 1975; Stein et al. 1975). Results from coastal areas are more variable, ranging from less than 5% (Craig and Mann 1974) to 72% (Kendel et al. 1975). Kendel et al. (1975) suggest that feeding activity may decline prior to or during coastal migrations. Such an explanation is consistent with the high percentage of empty stomachs recorded at Tuktoyaktuk during the present study since, as mentioned previously, most fish captured during the open water period were in the process of migrating, either out of the harbour (in July) or into the harbour (in September). Summer feeding areas for Arctic cisco may involve coastal bays and lagoons further up the coast from Tuktoyaktuk.

Overwintering: A large migration of Arctic cisco arrives in the Tuktoyaktuk area during September as fish which occupied summer feeding areas along the peninsula return to their overwintering locations. It is possible that most fish pass Tuktoyaktuk and continue on to overwintering areas in the Mackenzie Delta. However, it is clear that large numbers of Arctic cisco remain in the vicinity of Tuktoyaktuk and that the harbour itself is a major overwintering site for this species. During the present study a total of 107 Arctic cisco were captured through the ice. Overwintering fish were taken at all survey net sampling locations both inside the Harbour and in Kugmallit Bay (Appendix 1).

Least cisco

Distribution and relative abundance: In North America at least two distinct forms of least cisco occur, an anadromous form and another type that is usually restricted to lakes (McPhail and Lindsey 1970). The migratory form is common in coastal areas both east and west of the Mackenzie Delta during the summer months, but its abundance decreases as one moves away from the Mackenzie in either direction (Kendel et al. 1975; Mann 1974; Galbraith and Hunter 1975; Lawrence et al. in prep.). This suggests that the Mackenzie River is the source of all migratory least cisco in this area. Least cisco are known to penetrate the Mackenzie River beyond Fort Simpson but they are most abundant in the lower reaches of the watershed (Stein et al. 1973). Freshwater lakes within the Mackenzie Delta (Stein et al. 1973. Lawrence et al. in prep.) and along the Tuktoyaktuk Peninsula (Lawrence et al. in prep.; Fallis et al. in prep.) are utilized extensively by anadromous least cisco as summer feeding areas. Although an important commercial species in Siberian rivers (Nikolski 1961), least cisco are not harvested commercially in North America and the species occurs only incidentally in domestic catches within the Mackenzie Valley (Scott and Crossman 1973).

Least cisco was the most abundant species taken during the present study although the majority of those captured were small (<125 mm). Small mesh seines produced most (91.9%) of the least cisco captured and this species accounted for 31.3% of the total combined catch in all gear types (Table 5). During 1980, the largest seine catches of least cisco were made at Sites S4, S5, S6, and S15 (Fig. 3, Appendix 4) while good catches were made in 1979 at the mouths of Mayogiak and Freshwater creeks (Appendix 5). Swedish gillnets took least cisco offshore in Kugmallit Bay (Sites 5 and 11) and at both inshore and offshore locations within Tuktoyaktuk Harbour. Least cisco comprised 11.4% of the overall catch in Swedish nets (Table 5) and 11.6% of all fish captured in this gear at the five survey net sites within the harbour during 1980. Unfortunately, inshore locations were not sampled adequately for least cisco since this species was not susceptible to capture by the large mesh shore-based gillnets utilized. There is, however, some evidence that least cisco were more abundant near shore than at deeper offshore locations. For example, in 1979, when Swedish gillnets were set near shore, least cisco accounted for 22.4% of the catch (Appendix 2). As well, three Swedish nets, rigged to float and set inshore at Sites 21, 28, and 29 on 6-8 September 1980, captured 40 fish, of which 22 (55.0%) were least cisco. Other authors (Craig and Griffiths 1978; Galbraith and Hunter 1975; Byers and Kashino 1980) have reported least cisco to be more abundant in inshore areas than offshore. Galbraith and Hunter (1975), however, took this species 3.2 km offshore in Kugmallit Bay and considered the ciscoes (least and Arctic) to be more tolerant than other coregonids of the higher salinities and lower temperatures found north of Tuktoyaktuk. Of all least cisco captured at the five harbour survey net locations in 1980, 20.6% were taken on 15-16 August and 52.4% on 6-8 September. Most of these fish were taken at Site 6 (n=19), Site 3 (n=15), and Site 8 (n=10). No least cisco were ever captured at Site 9, the deepest location in the harbour.

Catch-per-unit-effort for least cisco in both Swedish gillnets and small mesh seines varied considerably throughout the study period (Fig. 16, Appendices 1 and 4). Swedish nets took only small numbers of cisco under ice, and the catch-per-unit-effort in this gear remained low until mid-July. A dramatic increase was noted, however, in August and September as large numbers of least cisco entered the study area. This major peak reflects the greatly increased catches made in mid-August and early September at Sites 6, 8, and 3. Byers and Kashino (1980) also reported good catches of least cisco in the Tuktoyaktuk area during September. This late summer, early autumn abundance is believed to represent a movement of least cisco from summer feeding areas along the Tuktoyaktuk Peninsula to overwintering areas. Mann (1974) believed that non-spawning least cisco returned to the Mackenzie River to overwinter.

Small least cisco, mostly 65 to 95 mm fork length (age 1), were present in Tuktoyaktuk Harbour in small numbers during the first half of July, 1980. Rapidly increasing catch-per-unit-effort values produced by small mesh seines (Fig. 16, Appendix 4) indicated a large migration of young-of-the-year ciscoes (mostly 35 to 55 mm) into the study area beginning approximately 15 July. This migration peaked near the end of July and catch-per-unit-effort then gradually declined during the remainder of the study period as the young ciscoes dispersed, supposedly to rearing areas along the coast of the Tuktoyaktuk Peninsula. Some small least cisco are known to enter fresh water systems during the summer (Fallis et al. in prep.; Lawrence et al. in prep.), and the large catches made near Mayogiak and Freshwater creeks during the present study and referred to earlier, suggest that these watersheds may be of importance to least cisco as rearing areas. Pelletier and Wilson (1981) reported taking small numbers of young-of-the-year least cisco from Tuktoyaktuk Harbour in October and November, 1980, during a dredge-monitoring study.

Age and growth: Least cisco from Tuktoyaktuk Harbour ranged in fork length from 35 to 401 mm with individuals less than 100 mm predominating (89%). Least cisco shorter than 125 mm were usually captured in seines while Swedish survey nets took fish between 105 and 401 mm. The range of fork lengths observed in the present study is similar to that reported from other coastal areas of the Beaufort Sea (Kendel et al. 1975; Percy 1975; Galbraith and Hunter 1975). Length-frequency distributions produced by gillnets in this area have been highly variable. Bimodal distributions were observed by Kendel et al. (1975) in Yukon coastal waters (150 and 275 mm) and by Percy (1975) in the outer Mackenzie Delta (215 and 270 mm) while Jones and den Beste (1977)reported a single mode at 250 mm for least cisco taken at Tuft Point on the Tuk Peninsula. Galbraith and Hunter (1975) showed a strong mode at 200 mm in each year of a three year study along the Tuktoyaktuk Peninsula but addition of a 2.5 cm mesh net during the second year resulted in an additional mode at a fork length of 150 mm. During the present study the length-frequency distribution observed in 1979 was distinctly different from that produced during 1980 although the same gear was employed in both years (Fig. 17). In the initial year of the study a single strong mode occurred at about 300 mm as 75% of the total catch (n=55) was between 250 and 324 mm fork length. During the second year fish of this size accounted for only 36% of the sample (n=107) as a strong mode, absent in 1979, appeared between 175 and 224 mm. This difference appears to be related to the occupation of different habitats by least cisco of different sizes. Although our data are not complete enough to permit a high degree of assurance there is at least an indication that larger least cisco are found in inshore areas than are found in deeper, offshore locations. For example, between 6 and 8 September 1980, 55 least cisco were captured in Swedish gillnets in Tuktoyaktuk Harbour. Fish taken at Sites 3, 6, 7, and 8 (n=33) ranged in length from 169 to 272 mm with a mean of 207 mm. This group of fish (70% between 175 and 224 mm) contributed significantly to the first mode seen in Fig. 17. Fishing simultaneously, floating Swedish nets set from and perpendicular to the shore (smallest mesh near shore) at Sites 21, 28, and 29 captured 22 least cisco. These fish ranged from 215 to 305 mm with a mean fork length of 262 mm and 68% of them were between 250 and 299 mm. The least cisco captured in 1979 were all captured at inshore locations.

No difference was observed between the length-frequency distributions for male and female least cisco captured during 1980. In 1979, however, a distinct difference was observed as females outnumbered males by a ratio of 10 to 1 among fish larger than 274 mm fork length (Fig. 17).

As mentioned previously least cisco taken in seines were usually less than 125 mm, but the length-frequency distribution varied throughout the summer (Fig. 18). Fish captured during the first half of July were mostly yearlings, ranging from 65 to 94 mm in fork length. In late July, however, the length-frequency shifted as a large migration of young-of-the-year fish (modal length 40-44 mm) entered the study area. Subsequent changes in the length-frequency distribution of least cisco captured in seines reflected the summer growth of fish in this year class.

Least cisco captured in Tuktoyaktuk Harbour ranged in age from 0 to 11 years. Young-of-the-year were by far the most abundant age group in both years of the study as small mesh seines produced 90% and 93% of the total least cisco catch in 1979 and 1980 respectively. As mentioned previously these young fish appeared in the harbour in large numbers during late July, but their abundance decreased after the end of July, supposedly as their dispersal continued. Based on 1980 data young least cisco had achieved a mean fork length of approximately 44 mm by late July and reached a mean length of about 67 mm by early September (n=18, range 44-86 mm). Six small least cisco captured during a dredge-monitoring operation in October and November, 1980 (Pelletier and Wilson 1981) ranged from 57 to 80 mm with a mean length of 72 mm. Age 1 fish, captured in mid-July, 1980, shortly after the beginning of their second growing season, had a mean fork length of 84 mm (Table 16).

Larger least cisco (those taken in gillnets) ranged from 1 to 11 years in 1979 and from 2 to 8 years in 1980. The majority (68%) of those taken in 1979 were age 7 to 9 (Appendix 6), considerably older than those captured in 1980 when age 3 (22%) and age 4 (27%) fish were most common and only 11% of the sample exceeded age 6 (Table 16).

The maximum scale age reported for least cisco from coastal Beaufort Sea locations is 11 years (Percy 1975; Kendel et al. 1975) while Stein et al. (1973) recorded a maximum age of 12 years in the Mackenzie River. Studies that have used otoliths for age determination have usually recorded a slightly higher maximum age. Mann (1974) and Galbraith and Hunter (1975) both obtained maximum otolith ages of 13 years for coastal locations while Griffiths et al. (1975) obtained a maximum otolith age of 16 years. Mann (1974) recorded a maximum otolith-based age of 25 years for this species in a small lake draining into the Beaufort Sea on the Yukon coast. Regardless of the method used in determining age, most authors have reported gillnet samples to be dominated by six- to nine-year-old fish. The exceptions are Mann (1974) and Kendel et al. (1975) who reported younger age structures, similar to that observed in Tuktoyaktuk Harbour in 1980.

The age-length relationship for least cisco from Tuktoyaktuk Harbour is similar to that reported for this species by other authors (Fig. 19). Studies that have employed the scale method of age determination (this study, Fallis et al. in prep; Percy 1975; Kendel et al. 1975) have tended to report a more rapid growth rate than those that have used otoliths. Mann (1974) compared the two methods and reported that scales generally do tend to underestimate age in this species. He found, however, that differences between scale age and otolith age did not become great until after growth became asymptotic (usually around age 10), and that the two methods agreed closely among younger age classes.

No significant differences ($P>0.05$) were found between the mean fork lengths of male and female least cisco of equal age (Table 16). Mann (1974) also reported males and females of this species to grow at the same rate.

The mathematical relationship between fork length and body weight for male least cisco taken from Tuktoyaktuk Harbour during the present study (n=58, range 172-305 mm) is described by the equation:

$$\log_{10}W = 2.784\ (\log_{10}L) - 4.506;\ SD_b = 0.134$$

For female least cisco (n=79, range 129-401 mm) this relationship is described by the equation:

$$\log_{10}W = 3.105\ (\log_{10}L) - 5.286;\ SD_b = 0.126$$

Analysis of covariance indicated a significant difference ($P<0.01$) between the slopes ($F=2.522$; 133 df) but not between the adjusted means ($P>0.05$; $F=0.721$; 134 df) of the length-weight regressions for male and female ciscoes.

Mann (1974) reported that within populations, few significant differences occurred in slope or adjusted means of the length-weight regressions between the sexes or between mature or immature fish. Between populations, however, the slope (b) tended to differ slightly.

Sex ratio and maturity: Based on 1980 data male and female least cisco occurred in equal numbers both within age groups and in the overall sample (Table 17). In 1979, however, females outnumbered males by 25 to 1 among fish older than 7 years (Appendix 6). Most studies in which an adequate sample size was available have reported male and female least cisco to occur in a 1:1 ratio (Mann 1974; Kendel et al 1975; Percy 1975).

Only 10.5% of least cisco examined in 1980 were considered to be capable of spawning in the current year (Table 17). The youngest mature male was age 5 while the youngest mature female was age 6. One immature non-virgin female was observed, indicating that some least cisco do not spawn every year. This fish was 280 mm in fork length and six years of age, having spawned, therefore, as early as age 5. Most studies in the Beaufort Sea area have placed the age of maturity for least cisco at between 4 and 9 years but have reported relatively few spawners in coastal waters (Mann 1974; Griffiths et al. 1975; Kendel et al. 1975; Percy 1975; Galbraith and Hunter 1975; Jones and den Beste 1977; Lawrence et al. in prep.).

Spawning: Results of the present study indicate that anadromous least cisco do not spawn in or near Tuktoyaktuk Harbour. Although small numbers of mature individuals were captured in late August and early September, most fish did not appear to be capable of spawning during the current season. Least cisco are believed to spawn in late September and early October in the Peel and Husky channels of the Mackenzie Delta, the Peel River, and the Arctic Red River (Stein et al. 1973).

Food habits: The stomachs of 108 least cisco were examined during the present study, 70% of which were empty. Those with food usually contained only small amounts. A similar high incidence of empty stomachs has been reported by other authors for least cisco captured at coastal locations (Jones and den Beste 1977; Kendel et al. 1975; Percy 1975) and during spawning runs in the Mackenzie River (Stein et al. 1973; de Graaf and Machniak 1977).

Laboratory analysis of the stomach contents of 31 Tuktoyaktuk Harbour least cisco (Table 18) revealed much of the material present to be unidentifiable remains, plant remains, and fish remains, these three categories comprising 34% of the total dry weight biomass. Among identifiable food items Copepoda was by far the most important, occurring in 57% of the stomachs that contained food and accounting for 54% of the total food biomass. Amphipoda (7% and 9%) and Chironomidae (18% and 0.6%) also appeared to be important. Other food items included insect remains, Mysidacea, Cladocera, Ostracoda, Acarina, and Foraminifera.

Least cisco are opportunistic feeders, consuming whatever food is available. While occupying Arctic coastal areas cisco appear to rely heavily on Crustacea, especially Amphipoda, Copepoda, Mysidacea, and Isopoda (Mann 1974; Stein et al. 1973; Lawrence et al. in prep.). Least cisco are also known to migrate from coastal areas into some tundra lakes during the summer, presumably for feeding purposes (Fallis et al. in prep.)

Overwintering: Least cisco were captured under ice in the vicinity of Tuktoyaktuk in April (n=2), May (n=7), June (n=2), January (n=3), and March (n=1), indicating that some least cisco do overwinter in Tuktoyaktuk Harbour and in Kugmallit Bay. Cisco have also been reported captured under ice in coastal waters by Percy (1975), Galbraith and Hunter (1975), and Steigenberger et al. (1975). Freshwater lakes in the Mackenzie Delta (Jessop and Lilley 1975) also serve as overwintering areas for anadromous least cisco.

Inconnu

Distribution and relative abundance: In North America this species ranges from the Kuskokwim River, Alaska to the Anderson River, N.W.T. It is distributed throughout the Mackenzie River system from brackish coastal areas of the outer Mackenzie Delta to Fort Nelson, B.C. on the Liard River and to the Fort Smith rapids on the Slave River (Scott and Crossman 1973). Inconnu in the lower Mackenzie are anadromous while those in Great Slave Lake are apparently not (MacPhail and Lindsey 1970). Anadromous and non-anadromous populations also occur in the Yukon River, Alaska (Alt 1977). Although found along the Beaufort Sea coast most inconnu venturing into brackish water are concentrated between Shingle Point to the west (Kendel et al. 1975) and Tuktoyaktuk Harbour to the east (Galbraith and Hunter 1975). Commercial fishing for inconnu in the N.W.T. occurs only on Great Slave Lake where an annual average of about 200,000 pounds has been taken since 1945 (Bond and Turnbull 1973). The species is important to domestic fisheries throughout the Mackenzie Valley, being utilized both for human consumption and as dog food.

Inconnu were common but never abundant in the vicinity of Tuktoyaktuk Harbour, accounting for only 1.9% of the total combined catch during the present study (Table 5). They made up 3.3% of the catch in Swedish gillnets and 8.2% of the total catch in large mesh shore-based gillnets. Although inconnu were taken offshore in Kugmallit Bay (Sites 4, 5, and 11) and at the deepest sites within Tuk Harbour (Sites 7 and 9), they were more common in shallow nearshore areas during the summer months. Inconnu were most frequently taken at Site 33 (five of seven sampling periods) with the largest individual catches occurring at Site 31 (n=13) and Site 28 (n=8) on 20-22 July.

The catch-per-unit-effort for inconnu captured in Swedish gillnets remained constant from 13 April to 13 June but decreased during July as most inconnu left the deeper areas of the harbour (Fig. 20, Appendix 1). Only seven inconnu were taken at the five survey net sites within the harbour during the open water period, three of which were captured at Site 9 on 15 August. Catch-per-unit-effort values in shore-based gillnets fluctuated throughout the ice-free period (Fig. 20, Appendix 3). Inconnu were most abundant in early summer as 52.5% of the total catch in large mesh gillnets was taken on 20-22 July. Figure 20 suggests a movement of inconnu from overwintering sites to summer feeding areas around the time of break-up. Many inconnu may move out of Tuktoyaktuk Harbour at this time, returning in late summer or autumn.

Age and growth: Inconnu varied in fork length from 75 to 933 mm with the majority (72%) being in the 450 to 599 mm range (Fig. 21). Only 16% of those sampled exceeded 600 mm. All fish longer than 700 mm were females; however, the modal length interval was the same for both sexes (500-549 mm). Inconnu taken during the present study were considerably smaller, on average, than those reported in catches from the lower Mackenzie River and outer delta (Stein et al. 1973; Percy 1975; de Graaf and Machniak 1977). These authors reported a much higher proportion of fish greater than 600 mm. In fact, Stein et al. (1973) reported that most inconnu captured at Aklavik and Arctic Red River were between 600 and 750 mm in fork length. Inconnu captured in coastal bays at Kittigazuit and Peninsula Point and in Tuktoyaktuk Harbour by Galbraith and Hunter (1975) ranged in length from 150 to 700 mm but only 8% of the sample exceeded 600 mm while 51% was less than 400 mm.

Scale ages, determined for 114 inconnu captured in Tuktoyaktuk Harbour during 1980, ranged from 4 to 17 years although the majority of fish (74%) belonged to age groups 5 to 8 inclusive (Table 19). As expected from the length-frequency distribution, inconnu from Tuktoyaktuk Harbour were younger than those reported from the lower Mackenzie River and outer delta where the majority of fish were reported to be age 8 to 13 inclusive (Stein et al. 1973; Percy 1975; de Graaf and Machniak 1977).

Male and female inconnu from Tuktoyaktuk Harbour grow at approximately equal rates although females appear to live longer and to attain larger sizes (Table 19). Among fish older than 10 years (n=11), 82% were females. Similar findings have been reported by Alt (1969, 1973) and by de Graaf and Machniak (1977).

The growth rate for inconnu from Tuktoyaktuk Harbour is among the slowest reported for North American populations. Among studies that have employed the scale method of age determination only Percy (1975) has reported a slower growth rate (Fig. 22). Authors utilizing otoliths have generally produced slower growth rates than those that used scales (Galbraith and Hunter 1975; de Graaf and Machniak 1977; Jones and den Beste 1977).

The length-weight relationship for male inconnu captured in Tuktoyaktuk Harbour during the present study (n=47, range 416-685 mm) is described mathematically by the equation:

$$\log_{10}W = 3.053\ (\log_{10}L) - 5.180;\ SD_b = 0.113$$

For female inconnu (n=72, range 387-933 mm) the equivalent expression is:

$$\log_{10}W = 3.243\ (\log_{10}L) - 5.689;\ SD_b = 0.055$$

Analysis of covariance indicated a significant difference ($P<0.01$) between the slopes ($F=2.568$; 115 df) but not the adjusted means ($P>0.05$; $F=1.159$; 116 df) of the length-weight relationships for male and female inconnu.

Sex ratio and maturity: No inconnu examined during the present study were considered to be capable of spawning in the current year. Most were virgin fish although some previous spawners were present. Gonadosomatic indices, calculated for 18 female inconnu ranging in fork length from 457 to 606 mm, varied from 0.1 to 0.3 with a mean of 0.2. One female (821 mm, Age 12) with a GSI value of 0.8 was probably a previous spawner. For male inconnu (n=5, range 459-597 mm) GSI values ranged from 0.1 to 0.2. Other studies have also found that inconnu inhabiting estuarine habitats during the summer months were largely immature individuals (Galbraith and Hunter 1975; Percy 1975; Jones and den Beste 1977; Alt 1979b). Mackenzie River inconnu begin to achieve sexual maturity at age 6 (Stein et al 1973; Percy 1975). In Alaskan streams males (5-9 years) mature at a younger age than females (7-12 years) with fish from faster growing populations maturing earlier than those from more slowly growing populations (Alt 1973).

Sex was determined for 107 inconnu of which 66 (62%) were females (Table 20). This represents a significant difference from a 1:1 ratio ($X^2=5.84$; $P<0.05$). Several other studies in this area (Percy 1975; de Graaf and Machniak 1977; Jones and den Beste 1977) have indicated a 1:1 ratio for inconnu with males outnumbering females by a slight amount. Galbraith and Hunter found no significant difference between the number of males (57%) and females in 1975; however, in their 1974 sample, males accounted for 68% of the total ($X^2=11.7$; $P<0.01$).

Spawning: No sexually mature individuals were captured during the present study, suggesting strongly that inconnu do not spawn in or near Tuktoyaktuk Harbour. The closest spawning areas for this species are believed to be located in the Peel and Arctic Red rivers (Stein et al. 1973).

In Alaska, where the migratory movements of anadromous inconnu have been studied extensively (Alt 1977), spawners leave overwintering areas in the lower reaches of large rivers or in brackish inlets before spring break-up to begin their summer-long migration to spawning areas located far upstream. A similar pattern for mature Mackenzie River inconnu may account for the absence of such fish at Tuktoyaktuk and other coastal locations during the summer months.

Food habits: Inconnu are opportunistic feeders, feeding on the most available prey species (Alt 1975). Young fry depend largely on plankton but switch to crustaceans and insects by the summer of their first year and are largely piscivorous by the second year (Alt 1973). During the present study 94 inconnu stomachs were examined, with 56 (60%) being empty. Fish or fish remains occurred in 87% of those stomachs that contained food and accounted for 96% of the dry weight food biomass in 13 stomachs examined in the laboratory. Fish species identified in the food included Arctic cisco, least cisco, rainbow smelt, and fourhorn sculpin. Amphipoda, Isopoda, and plant material were consumed in small quantities. In the Mackenzie Delta the frequency of empty stomachs for this species varied from 32% (de Graaf and Machniak 1977) to 84% (Percy 1975) with fish (lamprey ammocoetes, whitefish, inconnu, least cisco, pond smelt, ninespine stickleback, spoonhead sculpin, flounder, and pike) forming the bulk of the diet.

Overwintering: Tuktoyaktuk Harbour and Kugmallit Bay may be important overwintering areas for inconnu. During the present study inconnu were captured under ice in April (n=6), May (n=8), June (n=7), January (n=5), and March (n=3)(Appendix 1). Of 42 inconnu captured in Swedish gillnets, 29 (69%) were taken during the winter. A movement out of the harbour occurs in July. Inconnu are also known to overwinter in channels and lakes of the Mackenzie Delta and in coastal regions of the outer delta (Percy 1975; Jessop and Lilley 1975; Mann 1975; de Graaf and Machniak 1977; Jones and Kendel 1973).

Pacific herring

Distribution and relative abundance: In North America Pacific herring are found on the continental shelf and in coastal waters from Baja California northward to the Beaufort Sea (Hourston and Haegele 1980). They have been taken along the Yukon coast (Kendel et al. 1975) but are more abundant to the east of the Mackenzie Delta (Riske 1960; Bray 1975; Galbraith and Hunter 1975; Lawrence et al. in prep.). Although a marine species, found in abundance both inshore and offshore near Tuktoyaktuk (Galbraith and Hunter 1975), Pacific herring occasionally enter fresh water and have been reported as far upstream in the Mackenzie River as Aklavik (Hunter 1975).

During the present study Pacific herring accounted for only 2.8% of the total catch but made up 12.5% of the catch in Swedish gillnets (Table 5). Apart from eight specimens taken in seines in 1979 (Appendix 5) most herring were taken in the deeper, more saline waters of the harbour. Inshore locations were not sampled adequately for this species, however, as herring were not susceptible to capture in the large meshed shore-based gillnets. In 1979 Swedish gillnets, set inshore, captured herring in the mouth of Freshwater Creek (n=10) and in the mouth of Mayogiak Creek (n=1)(Appendix 5). Floating Swedish nets set inshore in 1980 at Sites 28, 29, and 21, captured no herring; however, sixteen herring (179-201 mm) were captured in a similar set made on 14 July at the mouth of Reindeer Creek (Fig. 3). This net was set perpendicular to the shore with the largest mesh closest to shore. The fish were captured in mid-channel, 50 m offshore, in the top 1.5m of the water column between 0200 and 1030 h. The largest catches of herring were usually made at Sites 3 and 9, while few (n=6) were taken at Site 8. Good catches were also made in January (n=10) and in March (n=10) at Site 12 (Fig. 3).

A pattern of seasonal movements is suggested by fluctuations in the catch-per-unit-effort values produced by Swedish gillnets (Fig. 23, Appendix 1). Herring were present in Tuktoyaktuk Harbour throughout the winter but the catch-per-unit-effort increased sharply in late May and early June. Examination of gonads revealed that spawning was very close at hand on 13 June and the increased catch-per-unit-effort was undoubtedly the result of activities related to preparation for that event. By 7 July, following break-up, the catch-per-unit-effort had fallen abruptly and few herring were captured in the harbour between 7 July and mid-August. It is suggested that, immediately after spawning, herring depart Tuktoyaktuk Harbour, migrating to offshore feeding areas. The location of these areas is not known. The return of the herring from the feeding areas began in late August. This event was reflected in rapidly increasing catch-per-unit-effort values in late August and early September (Fig. 23). Immature fish appear to accompany the spawners on these migrations.

Other coastal areas along the Tuktoyaktuk Peninsula may also provide overwintering and spawning sites for Pacific herring. Galbraith and Hunter (1975) reported large catches of herring in Hutchinson Bay and near Atkinson Point in late August. Lawrence et al. (in prep.) noted an increased abundance of Pacific herring in September at numerous inshore locations along the coast.

Age and growth: Pacific herring from Tuktoyaktuk Harbour ranged from 95 to 336 mm in fork length with the length-frequency distribution exhibiting a tri-modal character (Fig. 24). A small mode, occurring at about 100 mm, consisted of two-year-old fish and accounted for 4.4% of the total sample. A larger mode, consisting largely of age 4 and 5 fish, occurred between 175 and 199 mm and accounted for 28.3% of the sample. The third mode, consisting of mature fish, occurred between 275 and 324 mm. Of the total sample 53.5% lay within this length interval. Most of the fish in this group were age 8 to 13 inclusive. Our nets captured no fish between 125 and 149 mm fork length and only 11.9% of the total sample fell between 200 and 274 mm. Fish in the first group would be expected to be primarily two- and three-year-olds, while those in the second group would be mostly age 6 to 8. Riske (1960), fishing with basically the same gear as was used during the present study, described three modes in the length-frequency, those being at 190, 270 and 310 mm. Riske used a smaller length interval (10 mm) than was used in the present study. If fish captured during the present study are also separated into 10 mm intervals, the strong mode appearing between 275 and 324 mm (Fig. 24) is resolved into two, one at 280-289 mm and another at 310-319 mm, a situation very similar to that described by Riske. Riske attributed the gaps in his length-frequency distribution to gillnet selectivity and this was undoubtedly a major factor both in his work and in the present study. Results presented by Galbraith and Hunter (1975), however, raise a question as to whether these gaps can be explained wholly on the basis of gear selectivity. These authors used gillnets basically similar to those employed by us and by Riske (i.e. 38, 64, 89, 114, and 140 mm stretch mesh). In 1973, however, Galbraith and Hunter replaced the 64 mm mesh with a 51 mm net and, in 1974, some of their fishing was done using a gang consisting of 25, 51, 76, 102, and 127 mm mesh. Theoretically, the use of this gang should have helped fill in the gap between 230 and 270 mm. This was not the case, however, suggesting that factors other than (in addition to) gear selectivity are contributing to the length-frequency distribution.

Otolith ages for 81 Tuktoyaktuk Harbour herring (Table 21) varied from 2 to 15 years and the age composition reflected the bimodal length-frequency distribution of the sample. As mentioned previously most fish were either 4 or 5 years old or 12 or 13 years old. Females were larger than males of equal age but small sample sizes did not permit statistical testing of the significance of this difference. A similar situation was reported by Riske (1960) for Pacific herring in Tuktoyaktuk Harbour. He indicated a maximum age of 14 years for Tuktoyaktuk herring while a maximum age of 13 years was reported by Galbraith and Hunter (1975).

Comparison of growth curves (Fig. 25) indicates that herring taken during the present study grew more rapidly than those reported by Galbraith and Hunter (1975) but slower than the rates reported by Riske (1960) and by Fallis et al. (in prep.) for herring from Kukjuktuk Bay on the Tuktoyaktuk Peninsula. The results suggest a fairly rapid rate of growth up to age 9 for herring in this area but a slower rate in subsequent years. Herring from the Tuktoyaktuk Peninsula live longer and attain larger sizes than their Pacific coast relatives. Riske (1960) indicated that herring captured at Walker Rock, B.C. did not live beyond age 7 and that growth became asymptotic at about 200 mm fork length (Fig. 25).

The mathematical relationship between fork length and body weight for male Pacific herring from Tuktoyaktuk Harbour (n=69; range 163-330 mm) is described by the equation:

$$\log_{10}W = 3.463\ (\log_{10}L) - 6.060;\ SD_b = 0.103$$

The equivalent expression for female herring (n=77, range 155 - 336 mm) is $\log_{10}W = 3.374\ (\log_{10}L) - 5.872;\ SD_b = 0.062$

Analysis of covariance indicated a significant difference ($P<0.01$) between the adjusted means ($F=6.045$, 143 df) but not between the slopes ($P>0.05$, $F=0.585$, 142 df) of the regression lines for male and female herring.

Sex ratio and maturity: Sex was determined for a total of 146 Pacific herring (Fig. 24) of which 77 (53%) were females. The overall sex ratio, therefore, showed no significant difference from unity ($X^2=0.44$, $P>0.05$). A significant difference ($X^2=5.66$, $P<0.05$) was observed among smaller fish, however, (150-224 mm) as females (67%) outnumbered males. Riske (1960) found that female herring at Tuktoyaktuk outnumbered males throughout the entire length range of his sample and that their preponderance was greater among smaller fish (70%) than among larger ones (60%). In 1973, when the bulk of the sample consisted of small fish, Galbraith and Hunter (1975) found a significant difference ($X^2=3.88$, $P<0.05$) between the numbers of males and females with the latter comprising 60% of the sample. In 1974 and 1975, however, when the samples were dominated by larger fish, these authors found males and females to occur in approximately equal numbers with females (51%) outnumbering males in 1974 and males (56%) predominating during 1975. Tester (1937) reported that females usually outnumbered male herring in British Columbian populations and that the percentage of females increased gradually with age. He suggested that such a situation was a reflection of the earlier age of maturity and shorter life span of male herring.

Pacific herring on the west coast of North America first spawn at age 3 when their mean length is approximately 185 mm (Hourston and Haegele 1980). In the Arctic, however, herring mature later and at a larger size. Throughout their range, including the Arctic, spawning occurs annually. Riske (1960) reported that Pacific herring at Tuktoyaktuk spawn for the first time at age 6 when the fish have a mean fork length of approximately 260 mm. Riske's results would appear to be in line with those of the present study. During 1980 age and sex were determined for 74 Pacific herring (Table 22). The youngest male judged capable of spawning at the next spawning period was age 7 while the youngest mature female was age 8. Virtually all fish older than seven years were mature with the bulk of the spawning population being age 11 and 12. With one exception, all fish greater than 250 mm fork length were considered to be sexually mature. The youngest mature fish captured during 1979 was a six-year-old male, 223 mm in fork length.

The pattern of gonadal development in Atlantic herring varies between the sexes with males developing earlier in the year but with both sexes becoming full and ripe by December, after which little change occurs until spawning in May and June (Tibbo 1956). The same type of pattern is evident for Pacific herring in the vicinity of Tuktoyaktuk. Here, the gonads of the males are close to full development by September while those of many of the females have apparently still not recovered fully from the previous spawning. No herring ovaries were weighed in September during the present study. Riske (1960), however, reported September GSI values for male herring to range from 13.7 to 17.9 with a mean of 15.9. At the same time, GSI values for mature females varied from 4.6 to 7.2 with a mean of 6.1. According to Riske testes were three quarters full to ripe and running at that time while ovarian development was not so advanced. On 20 March 1981, six male herring had a mean GSI value of 13.4 with individual values ranging from 11.6 to 15.2. These values are somewhat less than the September values of Riske (1960) but were derived from somewhat smaller fish (fork length range 247-296 mm vs 299-329 mm).

While the male gonads undergo little change during winter those of the females grow rapidly, with GSI's increasing to more than 20.0 by spawning time in mid-June (Table 23). Commercial herring roe fisheries on Canada's west coast occur on the spawning grounds. Just prior to spawning the eggs absorb water and their weight increases rapidly producing GSI values of from 20.0 to 35.0 (Hourston and Haegel 1980).

Non-spawning, immature females (n=4, fork length 175-215 mm), captured in Tuktoyaktuk Harbour in January 1981, had a mean GSI value of 0.4 with individual values ranging from 0.2 to 0.6.

Spawning: Pacific Herring in British Columbia spawn from February to July with the heaviest concentrations in March (Hart 1973). Spawning time is progressively later towards the northern portion of their range (Rounsefell 1930) with spawning occurring at water temperatures of 3.0 to 12.3°C (Hart 1973). After spawning, adults return to offshore feeding areas which may or may not coincide with summer feeding areas of non-spawners (Hourston and Haegele 1980). The incubation period ranges from 10 to 21 days after fertilization, depending on water temperature (Hourston and Haegele 1980).

Percy (1975) reported that Pacific herring captured in the outer Mackenzie Delta in March had not spawned whereas those taken in July had completed spawning. Riske (1960) suggested that herring of the Beaufort Sea probably spawn in July shortly after break-up. During the present study herring were fully mature by late May and ripe male and female fish were captured on 12 June. A ripe male and female and a spent male were taken just after break-up on 7 July. It was evident from catch-per-unit-effort values, however, (Fig. 23) that most herring had left the Harbour by this time, suggesting that most spawning had occurred by break-up or during break-up. The last two weeks of June would appear to be the most likely time. The greatest concentration of herring observed during mid-June occurred at Sites 7, 6, 9, and 3 (Appendix 1), suggesting that spawning may occur in deeper waters throughout the harbour. Water temperatures at these sites on 28 May 1980 ranged from 0.0 to 0.2°C while salinity near the bottom varied from about 20 to about 30‰ (de March in prep.). Hunter (1975) reported capturing larval herring along the Tuktoyaktuk Peninsula in mid-July. Jones and den Beste (1977) captured young-of-the-year (27 to 38 mm) in late August.

Food habits: The first food of young Pacific herring on the west coast consists of invertebrate eggs, Copepoda, and diatoms. During the first summer, as the fish grow, the diet broadens to include other forms but Copepoda remain the most common food. Adults rely mainly on Crustacea and small fishes (Hart 1973). According to Hunter (1975) herring remain plankton feeders throughout life. Kendel et al. (1975) and Percy (1975) examined small numbers of Pacific herring along the coast of the western Beaufort Sea, reporting that they had fed mainly on Mysidacea, Copepoda, and Amphipoda. Galbraith and Fraser (1974) and Jones and den Beste (1977) reported Amphipoda and Mysidacea to be the most common food of herring along the Tuktoyaktuk Peninsula.

During the present study a total of 130 Pacific herring stomachs were examined to determine food habits, of which 53 (41%) were empty. Among 105 stomachs subjected to detailed laboratory analysis (Table 24), unidentified remains occurred in 41% of all stomachs that contained food, accounting for 74% of the total dry weight biomass. Copepoda, found in 44% of all stomachs containing food and comprising 15% of the total food biomass, was the most important food, followed in importance by Acarina, eggs, and plant remains.

Judging from the total dry weight of food found in the stomachs of Tuktoyaktuk harbour herring (0.62 g), herring did not appear to be feeding heavily while in the harbour. This would be expected if Tuktoyaktuk herring behaved as those described by Hart (1973), who stated that herring feed in offshore feeding areas during the summer and cease feeding in late fall after their inshore migration, ripening gametes through the winter at the expense of stored oil. Carlson (1980) also reported that Pacific herring ceased feeding upon reaching the wintering grounds.

Overwintering: Tuktoyaktuk Harbour is a major overwintering area for Pacific herring. Rapidly increasing catch-per-unit-effort values in late August and September (Fig. 23, Appendix 1) indicated a large migration into the harbour, supposedly representing a return of fish from offshore feeding areas. Herring were captured through the ice in April (n=2), May (n=14), June (n=28), January (n=23), and March (n=14)-(Appendix 1). During the winter herring may be dispersed throughout the deeper areas of Tuk Harbour but increased catch-per-unit-effort values at most sites in late May and June suggest a concentration at specific spawning sites or at least increased activity on the part of the fish at that time. As mentioned previously a post-spawning migration out of the harbour occurs in late June and few herring are to be found in the harbour from early July to mid-August. Other coastal bays along the Tuktoyaktuk Peninsula and Richard's Island also experience an increased abundance of Pacific herring during autumn, suggesting widespread utilization of such areas for overwintering and, perhaps, spawning as well (Lawrence et al. in prep.). Percy (1975) captured four herring through the ice in Mallik Bay during March, 1975.

Rainbow smelt

Distribution and relative abundance: In this area rainbow smelt are anadromous, migrating from the sea into the Mackenzie River at least as early as March (Percy 1975) to spawn near the head of the delta in the vicinity of Arctic Red River (Stein et al. 1973). Spawning runs are not known to occur in any other Beaufort Sea drainages. Smelt leave the Mackenzie River immediately after spawning and are not found in the upper delta after early June (Stein et al. 1973). They are abundant in the outer delta at break-up but have left the delta channels by July (Percy 1975). Although reported from the Yukon coast as far west as Herschel Island (Kendel et al. 1975) and beyond McKinley Bay on the Tuktoyaktuk Peninsula (Lawrence et al. in prep.), their major summer feeding area appears to lie in Kugmallit Bay from Richard's Island to Tibjak Point just north of Tuktoyaktuk (Percy 1975; Galbraith and Hunter 1975; Byers and Kashino 1980; Lawrence et al. in prep.). In the vicinity of Tuktoyaktuk rainbow smelt can be captured throughout the water column (Byers and Kashino 1980) and at both inshore and offshore locations. At offshore locations they are often the dominant fish species present (Percy 1975; Byers and Kashino 1980).

Smelt were not captured in Tuktoyaktuk Harbour during the winter. They began to appear in Swedish gillnets in mid-July, however, and the catch-per-unit-effort in this gear increased sharply throughout August and early September (Fig. 26, Appendix 1). The largest catches inside the harbour were made at Sites 3, 6, and 7 on 15-16 August, and at Sites 3, 6, 7, and 9 on 6-7 September. Only two smelt were captured at Site 8. During 1979, Swedish gillnets captured 17 smelt in the mouth of Freshwater Creek (Appendix 2). Overall, this species accounted for 6.4% of the total catch in Swedish gillnets (Table 5). Byers and Kashino (1980), also utilizing Swedish gillnets, found rainbow smelt to be abundant inside Tuktoyaktuk Harbour on 15 August. Their catch decreased considerably, however, by 4 September and no smelt were captured on 25 September.

Small mesh seines captured only 30 rainbow smelt in Tuktoyaktuk Harbour during 1980. Fry were captured at all seining locations except S5 and S8. Most, however, were taken at Site S1 (50%) and Site S2 (23%). The catch-per-unit-effort for these small smelt increased greatly in mid-August but had decreased abruptly by 9 September (Fig. 26, Appendix 4). Most of the small smelt taken in seines were young-of-the-year measuring 22 to 38 mm in length. A few yearlings (age 1+, 43 - 57 mm) were also present. Using seines and otter trawls, Byers and Kashino (1980) captured many small smelt (25 - 99 mm) outside the harbour in Kugmallit Bay during August and September. The 1979 seine catch totalled 118 smelt, of which 90 (76%) were taken in the mouth of Freshwater Creek on 29 August (Appendix 5).

Rainbow smelt were not susceptible to capture in large mesh gillnets although a total of eight were taken in this gear, having become entangled by their teeth.

Age and growth: Rainbow smelt captured in Tuktoyaktuk Harbour during the present study ranged in fork length from 22 to 350 mm. Excluding those taken in seines lengths varied from 193 to 350 mm, the majority (83%) being between 200 and 274 mm (Fig. 27). Males had a smaller modal length (225-249 mm) than females (250-274 mm). The length-frequency distribution in the present case is virtually identical to those reported by Percy (1975) and Galbraith and Hunter (1975). Byers and Kashino, however, captured a higher proportion of smaller fish in their gillnets, resulting in a modal length in the 200 to 224 mm range.

Otolith ages, determined for 45 rainbow smelt during 1980 (Table 25), ranged from 4 to 11 years with most fish (62%) being age 7 or 8. The oldest rainbow smelt reported for this area was age 13 (Galbraith and Hunter 1975) although most fish captured in gillnets have been reported to be 5 to 8 years of age (Stein et al. 1973; Percy 1975; Galbraith and Hunter 1975). Female smelt were slightly larger than males of the same age and all fish older than 9 years were females. McKenzie (1958) and Bailey (1964) report that female smelt in the Miramichi River, New Brunswick and Lake Superior, respectively, also grow faster and live longer than the males.

The growth rate of Tuktoyaktuk Harbour smelt was found to be similar to but slightly slower than that reported by Percy (1975) for smelt taken from the outer Mackenzie Delta (Fig. 28). Growth was also similar to that described by Fallis et al. (in prep.) for smelt from Kukjuktuk Bay. Galbraith and Hunter (1975), on the other hand, indicated little or no growth occurring after age 6. Smelt from the Beaufort Sea appear to grow more slowly during the first few years of life than do the anadromous rainbow smelt of the Miramichi River, but the northern fish live longer and reach larger sizes than do those of the southern population.

The mathematical relationship between fork length and body weight for male rainbow smelt from Tuktoyaktuk (n=60, range 193-278 mm) is described by the equation:

$$\log_{10}W = 3.362\ (\log_{10}L) - 5.986;\ SD_b = 0.205$$

The corresponding equation for female smelt (n=38, range 210-350 mm) is:

$$\log_{10}W = 2.589\ (\log_{10}L) - 4.158;\ SD_b = 0.245$$

analysis of covariance indicated a significant difference ($P<0.01$) between the slopes ($F=6.106$; 94 df) but not between the adjusted means ($P>0.05$, $F=0.958$, 95 df) of the length-weight regressions for male and female smelt. No difference in the regression coefficient for male and female smelt was reported by Percy (1975), Bailey (1964), or McKenzie (1958). The fact that such a difference did occur in the present study may be attributable to small sample size.

Sex ratio and maturity: Sex was determined for 98 rainbow smelt during the present study of which 60 (61%) were males. This represents a significant difference from a 1:1 ratio ($X^2=4.94$; $P<0.05$). In 1979, 17 of 19 sexed fish were males while, in 1980, males outnumbered females by 43 to 28. During 1980, therefore, no significant difference was observed between the numbers of male and female smelt ($X^2=3.16$; $P>0.05$). Galbraith and Hunter (1975) found male and female smelt to be present in equal numbers in 1973 and 1974, but in 1975, males were significantly more numerous than females ($X^2=16.23$; $P<0.01$).

Rainbow smelt achieve sexual maturity at different ages in different parts of their range. In the Miramichi River, New Brunswick, smelt generally mature at the end of their second year (McKenzie 1958) while the anadromous European smelt matures at age 3 or 4 (Nikolski 1961). In our study area smelt appear to mature at about age 6 (Stein et al. 1973; Percy 1975). During the present study, sex and age were determined for 44 smelt (Table 26). The youngest mature male observed was age 7 while the youngest mature female was age 10.

Spawning: Rainbow smelt spawn in the Mackenzie River or its tributaries just prior to spring break-up. Immediately after spawning the adult fish leave the river, moving downstream to summer feeding areas in Kugmallit Bay. According to Percy, this migration has passed the outer delta by July. During the present study fourteen spent smelt were captured at Site 5

(Fig. 3) on 9 July. Following emergence smelt fry are carried out of the Mackenzie River on the spring flood and sac fry (19-28 mm) have been taken in Stokes Lagoon on the Yukon coast as early as 18 July (Kendel et al. 1975). Substantial numbers of sac fry were also captured in the east channel of the Mackenzie River in early July 1980 (Chang-Kue and Jessop in prep.). Large numbers of young-of-the-year smelt were present in the vicinity of Tuktoyaktuk during August and September, 1980 (Byers and Kashino 1980), although only 27 were captured inside Tuktoyaktuk Harbour during the present study.

Food habits: Forty-one smelt stomachs were examined in the field during the present study. Of this number, 31 (76%) were empty while the remainder contained fish remains and other digested material. A more detailed study of 15 stomachs in the laboratory (Table 27) indicated a diet based heavily on Crustacea which comprised more than 53% of the dry weight food biomass. Amphipoda were the single most important food item, occurring in 38% of the stomachs containing food and making up 36% of the total food biomass. Mysidacea (31% and 12%) and Isopoda (23% and 5%) were also consumed in quantity. Other food items included Gastropoda, Ostracoda, eggs, fish remains, and plant remains. The only fish species identified in the food was least cisco. A similar diet for adult smelt was described by Percy (1975), who also reported that smelt fry consumed Mysidacea, Chironomidae, and Copepoda (Percy 1975). Kendel et al. (1975) reported that 92.4% of the diet of smelt captured along the Yukon coast consisted of Amphipoda, Mysidacea, and Isopoda while adult Asiatic smelt feed predominantly on Amphipoda, Mysidacea, larval Chironomidae, and small fish (Nikolski 1961). A diet consisting mostly of fish (smelt and cod), however, is reported by Galbraith and Fraser (1974) for smelt along the coast of the Tuktoyaktuk Peninsula.

Overwintering: Results of the present study indicate that although smelt enter Tuktoyaktuk Harbour during late summer, they do not overwinter there. The results of Byers and Kashino (1980) suggest that smelt leave the harbour by the end of September. Most smelt probably overwinter in Kugmallit Bay with spawners entering the river channels of the outer delta by March preparatory to their upstream spawning migration.

Other species

Fourhorn sculpin: The fourhorn sculpin is circumpolar in cold, brackish waters and is the most abundant marine species gillnetted along the Beaufort Sea coast (Kendel et al. 1975; Percy 1975; Galbraith and Hunter 1975; Bray 1975; Griffiths et al. 1975, 1977; Jones and den Beste 1977; Craig and Griffiths 1978; Byers and Kashino 1980; Lawrence et al. in prep.). Although of no commercial importance fourhorn sculpins are an important food chain organism, providing forage for mew gulls, whitefish, burbot, Arctic sculpin, eelpout, and Arctic char (Griffiths et al. 1975), as well as inconnu (Kendel et al. 1975). They are sometimes used as fox bait by residents of Tuktoyaktuk (H. Gruben Personal Communication, August 1980). Griffiths et al. (1975) considered fourhorn sculpin to be of special interest because it appears to be the only marine species utilizing nearshore habitats for spawning, rearing, feeding, and overwintering.

Fourhorn sculpin accounted for 8.7% of all fish taken during the present study, making up 22.7, 9.6, and 3.8% of the catch in Swedish gillnets, large mesh gillnets, and seines, respectively (Table 5). Among those species considered to be marine, sculpins clearly predominated (49.5%). Sculpins were not captured in Kugmallit Bay under ice but were taken in small numbers by Swedish gillnets inside Tuktoyaktuk Harbour throughout the winter (Fig. 29, Appendix 1). A major movement of fourhorn sculpin occurred in early July. Although none was captured in Kugmallit Bay during winter, Swedish gillnets, set 9 July at Site 5 (330 minute set) and Site 11 (285 minutes), captured 192 and 56 sculpins, respectively. By mid-July the abundance of fourhorn sculpin had increased noticeably at the survey net sites within the harbour (except at Site 8 where no sculpins were ever captured) and high catch-per-unit-effort values were recorded at inshore locations (Fig. 29). Sculpins had vacated most inshore locations by late July, having apparently moved to deeper parts of the harbour where the highest catch-per-unit-effort values in Swedish nets were recorded in mid-August. By early September catch-per-unit-effort had again increased at inshore Sites 21, 29, 30, 31, and 33, suggesting the possibility of a migration out the harbour, or at least a movement from deeper to shallower parts of the harbour, at that time. This pattern of movements, to deeper areas in early summer with a return to shallow zones in late summer or autumn, is similar to that described by Westin (1970) for fourhorn sculpin on the coast of Sweden. Westin believed that the migration into deeper water was undertaken to escape the high summer water temperatures (9°-10°C) occurring in the shallows. A similar explanation may be applicable to the movement pattern observed during the present study. Surface water temperatures in Kugmallit Bay and Tuktoyaktuk Harbour had reached 9°C by late July, 1980, and maximum temperatures of 13.2°C were recorded in mid-August. By mid-September surface temperatures had decreased to approximately 4°C (de March in prep.).

Young-of-the-year sculpins were not captured until 13 August when they were taken at Sites S2, S3, S4, S5, S6, and S15. The high catch-per-unit-effort produced on that date in small mesh seines (Fig. 29, Appendix 4) resulted from the capture of large numbers (n=54) of young sculpins (24-40 mm) at Site S15.

Fourhorn sculpins captured in gillnets during the present study ranged in total length from 80 to 396 mm with 69% being between 175 and 274 mm (Fig. 30). This is similar to length-frequency distributions reported by Percy (1975) and Griffiths et al. (1975, 1977). Smaller modal lengths have been reported by Jones and den Beste (1977) on the Tuktoyaktuk Peninsula and by Craig and Griffiths (1978) at Simpson Lagoon, Alaska. Seines captured fourhorn sculpins between 24 and 77 mm in total length, the vast majority (87%) being from 25 to 39 mm (Fig. 31). As mentioned previously most of these small fish are believed to be young-of-the-year. Very few fish in the range 40 to 149 mm were taken during the present study, a situation also reported by other Beaufort coast studies.

Otolith ages for fourhorn sculpin (n=30) ranged from 4 to 16 years with most fish (77%) being age 7 to 11 inclusive (Table 28). A maximum otolith age of 14 years was reported for this species by Percy (1975) and by Griffiths et al. (1975). Although our sample was small, sculpins from Tuktoyaktuk Harbour appear to grow at approximately the same rate as indicated for those at Kaktovik Lagoon (Griffiths et al. 1977) and Simpson Lagoon (Craig and Griffiths 1978) on the Alaskan coast, and by Jones and den Beste (1977) on the Tuktoyaktuk Peninsula. A more rapid growth rate was reported by Percy (1975) from the outer Mackenzie Delta while fish from Nunalak Lagoon, Yukon (Griffiths et al. 1975) grow much more slowly.

The mathematical relationship between total length and body weight for fourhorn sculpin captured from Tuktoyaktuk Harbour during the present study (sexes combined, n=161, range 80-363 mm) is described by the equation

$$\log_{10}W = 3.081 (\log_{10}L) - 5.275; SD_b = 0.067$$

All fourhorn sculpins for which sex was determined during the present study (n=40) were females (Table 28). Most other studies on the Beaufort coast have also found females to be significantly more numerous than males (Kendel et al. 1975; Percy 1975; Galbraith and Hunter 1975; Griffiths et al. 1975; Craig and Griffiths 1978). Jones and den Beste (1977), however, reported a 1:1 sex ratio while Griffiths et al. (1977) found significantly more males than females.

Of the 40 fish whose gonads were examined directly during this study, only four (all spent females) were sexually mature. Three of these (280-315 mm) were taken at Site 3 on 25 July 1979 while the fourth (396 mm) was captured at the entrance to Aveltkok Inlet on 9 July 1980. More importantly, a ripe and running female was captured at Site 12 on 8 January 1981, indicating that at Tuktoyaktuk, as on the Baltic coast (Westin 1968), fourhorn sculpin spawn in mid-winter, and suggesting that the species does spawn within Tuktoyaktuk Harbour. The extent to which sculpins spawn within the harbour is not known, but may be limited as young-of-the-year were not captured until 13 August, at which time they were quite large (modal length 30-34 mm). At other locations on the Beaufort coast, young sculpins ranging in length from 12 to 26 mm have been captured between early July and early August (Kendel et al. 1975; Griffiths et al. 1975, 1977; Jones and den Beste 1977; Craig and Griffith 1978).

The youngest mature sculpin examined during the present study was 11 years old. Most other studies agree that fourhorn sculpin mature at age 3 to 5 in this region with males tending to mature earlier than females (Griffiths et al. 1975, 1977; Jones and den Beste 1977; Craig and Griffiths 1978).

Isopoda were the most common food of fourhorn sculpin examined during the present study, occurring in 71% of all stomachs that contained food and accounting for 26% of the diet in terms of dry weight biomass (Table 29). Amphipoda were found in 52% of all stomachs, but made up only 6% of the dry weight biomass while fish, with a frequency of occurrence of 10%, accounted for 11% of the food in terms of biomass. Other foods included Mysidacea, Ostracoda, Polychaeta, Ascidiacea, Nematoda, Hydrozoa, fish eggs, and plant and mammal remains. Fourhorn sculpin from other coastal areas are reported to feed largely on Crustacea with the percentage of empty stomachs ranging from 5 to 37% (Furniss 1975; Griffiths et al. 1975, 1977; Kendel et al. 1975; Percy 1975; Jones and den Beste 1977).

Starry flounder: The starry flounder is one of the most widely distributed flounders in coastal areas of the Pacific and Arctic oceans. Although found mainly in shallow, brackish areas, it has been captured at depths greater than 150 fathoms (275 m) and frequently enters streams (Orcutt 1950; Nikolski 1961). In the Canadian Arctic starry flounder are distributed eastward to Bathurst Inlet or Queen Maude Gulf (Walters 1955) and have been reported from numerous coastal locations in the southern Beaufort Sea area (Percy 1975; Kendel et al. 1975; Galbraith and Hunter 1975; Jones and den Beste 1977; Byers and Kashino 1980; Lawrence et al. in prep.; Fallis et al. in prep.). Although rarely taken offshore in Kugmallit Bay starry flounder are common in Tuktoyaktuk Harbour throughout the year and accounted for 3.4% of the total combined catch during the present study. Only 13 starry flounder were captured in small mesh seines, but this species contributed 10.4% of the catch in Swedish gillnets and 6.4% of that in large mesh gillnets (Table 5). During 1980, starry flounder were taken at all survey net sites within the harbour and at all shore locations except Site 21. In 1979 Swedish nets captured starry flounder in the mouth of Freshwater Creek as well as at the mouth of Mayogiak Creek and at Reindeer Creek (Appendix 2).

During 1980 the catch-per-unit-effort for starry flounder varied considerably from site to site, reflecting movements between spawning and overwintering areas. Generally, the pattern of movement seemed to involve an onshore movement in early July (possibly late June) followed by a dispersal away from inshore sites toward deeper water during the summer. From mid-April to mid-June most (58%) of the starry flounder captured at the five survey net sites within the harbour were taken at Site 3. On 7-9 July no flounder were taken at Site 3 but an abundance peak occurred in Fig. 32 because of increased catches at Sites 7, 8, and 9. By 13-16 July, low catch-per-unit-values were recorded at all five sites. Between 2 August and 7 September most (55%) of the starry flounder taken at these sites were again captured at Site 3 (Appendix 1).

That a large inshore movement occurred in early July was confirmed by catches made in Swedish gillnets set at inshore locations during that period. One net, set at the mouth of Aveltkok Inlet on 9 July, took 20 starry flounder in 225 minutes. A second net, set from shore at Reindeer Creek and checked every two or three hours from 1230 h on 13 July to 1030 h on 14 July, captured 30 specimens. The capture of a spent female at Aveltkok Inlet and two ripe males at Reindeer Creek at this time suggests that the inshore movement was indeed related to spawning.

Starry flounder were still abundant in inshore areas on 20-22 July when sampling with large mesh nets began. During that first sampling period flounder were captured at all inshore locations except Site 21 but seemed to be more abundant toward the south end of the harbour as 64% of the catch was taken at Sites 25, 26, 27, and 28 (Appendix 3). After 20-22 July catch-per-unit effort at inshore sites fluctuated somewhat but tended generally to decline as the summer progressed (Fig. 32).

Starry flounder ranged from 28 to 370 mm with 68% being between 225 and 274 mm in total length (Fig. 33). Seines took flounder measuring from 28 to 230 mm but only one fish captured in this gear exceeded 59 mm. Byers and Kashino (1980) reported a maximum length of 440 mm for starry flounder at Tuktoyaktuk.

The combined length-weight relationship for starry flounder captured in Tuktoyaktuk Harbour (n=161, range 195-370 mm) is described by the equation

$$\log_{10}W = 3.269\ (\log_{10}L) - 5.564;\ SD_b = 0.095$$

Very little work has been done on the age and growth of starry flounder in the southern Beaufort Sea area. Small numbers were aged by Percy (1975) and by Jones and den Beste (1977) with both studies reporting a maximum otolith age of 15 years. During the present study, otolith ages for 50 starry flounder ranged from 8 to 42 years. Fish of age groups 11 and 12 were the most common, comprising 40% of the sample (Table 28). Starry flounder from Tuktoyaktuk Harbour appear to grow more slowly and live much longer than those off California where a maximum scale age of eight years was reported (Orcutt 1950).

Sex was determined for 69 starry flounder of which 43 (62%) were males. The youngest male considered capable of spawning during the next spawning period was age 8 while the youngest mature female observed was age 10 (Table 28). Males and females on the California coast are said to mature at age 2 and 3, respectively (Orcutt 1950).

Starry flounder spawn in December and January in California and from February to April off the coast of British Columbia (Hart 1973). In Tuktoyaktuk Harbour spawning takes place between early June and mid-July, and is probably concentrated from late June to early July, or around the time of break-up. The abundance of this species at inshore harbour locations in early July, referred to earlier, was undoubtedly related to spawning activity. Most flounders examined between 17 April and 12 June 1980 were considered mature but not yet ripe. A ripe male was taken, however, on 1 June at Site 8, and ripe (running) males were taken on 13 July at Site 3. A spent female was recorded on 9 July at the entrance to Aveltkok Inlet (Fig. 3).

A total of 32 starry flounder stomachs were examined during the present study of which seven (22%) were empty. Laboratory examination of 27 stomachs showed the diet of this species to be dominated by Crustacea and Mollusca (Table 30). Amphipoda, Isopoda, and Pelecypoda were the most common food items, occurring in 67, 46, and 29% of those stomachs that contained food. Pelecypoda accounted for 40% of the total food biomass, while Isopoda and Amphipoda contributed 17% and 11% respectively. Polychaeta, Oligochaeta, Chironomidae, Hydrozoa, eggs, fish remains, and plant remains also occurred in the diet. Starry flounder from the outer Mackenzie Delta had fed largely on Isopoda and plant remains (Percy 1975) while those taken at Tuft Point had consumed Amphipoda and Coregonid fry (Jones and den Beste 1977).

Arctic flounder: The Arctic flounder has a circumpolar distribution in brackish coastal areas, sometimes entering rivers (Nikolski 1961). It is found in the Canadian Arctic eastward to Bathurst Inlet or possibly Queen Maude Gulf (Walters 1955) and has been reported from many coastal locations in the southern Beaufort Sea area (Kendel et al. 1975; Percy 1975; Galbraith and Hunter 1975; Griffiths et al. 1975, 1977; Jones and den Beste 1977; Lawrence et al. in prep.; Byers and Kashino 1980).

Arctic flounder were common in Tuktoyaktuk Harbour during the present study but were never captured offshore in Kugmallit Bay. Byers and Kashino (1980) also failed to capture this species at offshore locations. Overall, Arctic flounder accounted for 2.3% of the combined catch during the present study, contributing 6.3, 3.1, and 0.7% of the catch in Swedish nets, large mesh gillnets, and small mesh seines, respectively (Table 5). During 1980 Arctic flounder were taken at all five survey net sites within Tuktoyaktuk Harbour, with the majority (52%) being captured at Site 3 (Fig. 3). Fluctuations in the catch-per-unit-effort for Arctic flounder at the five survey sites (Fig. 34) suggest that flounder overwinter in the deeper areas of Tuktoyaktuk Harbour then leave these areas in late March, returning to deep water in late August and September. Swedish gillnets, set inshore in early July, provided evidence that this decrease in the abundance of flounders at the five survey net sites was the result of a general movement into the nearshore area. A Swedish net set from shore at the entrance to Aveltkok Inlet on 9 July took nine Arctic flounder in 225 minutes. In addition, 50 flounders were captured inshore at Reindeer Creek (Fig. 3) on 13-14 July. All fish were taken in the first 15 m from shore where the lead line of the net was on the bottom. Thirty-nine of these fish were taken between 1230 h and midnight while only 11 were captured between midnight and 1030 h. During the summer Arctic flounder remained more abundant at inshore locations within Tuktoyaktuk Harbour than in the deeper offshore areas, and were taken at all inshore sites except Site 21 (Appendix 3).

Small mesh seines captured Arctic flounder at Sites S7 (n=7), S4 (n=7), S15 (n=5), S2 (n=4), S5 (n=2), and S6 (n=1) (Appendix 4). By September small flounder had apparently departed inshore areas and the catch-per-unit-effort in small mesh seines fell to zero (Fig. 34).

Arctic flounder captured in Tuktoyaktuk Harbour during the present study ranged in total length from 29 to 329 mm, the majority (81%) being between 200 and 324 mm (Fig. 35). Seines took flounder measuring 29 to 204 mm with 62% of the sample being 50 to 124 mm in length. Arctic flounder reported by Percy (1975) and Jones and den Beste (1977) were not as large on average although these authors observed similar size ranges.

The length-weight relationship for Arctic flounder from Tuktoyaktuk Harbour (sexes combined, n=107, range 140-325 mm) is described by the equation

$$\log_{10}W = 2.910\ (\log_{10}L) - 4.661;\ SD_b = 0.081$$

Otolith ages for 21 fish ranged from 5 to 20 years and only one fish, a 14-year-old male, was considered to be sexually mature (Table 28). Jones and den Beste (1977) reported a maximum age of 11 years for this species with males and females maturing at least as early as age 5 and 8 respectively. Percy (1975) recorded a maximum otolith age of 12 years in the outer Mackenzie Delta and indicated that sexual maturity was first reached at age 5. Arctic flounder are reported to spawn for the first time at age 4 or 5 in the Soviet Union (Nikolski 1961).

Whereas most of the Arctic flounder examined during the present study were judged to be sexually immature, or not capable of spawning during the present year, Jones and den Beste (1977) reported 72% mature fish in their sample. It seems highly probable that some fish called immature in the present study were, in fact, mature. The failure to identify such fish as mature could have resulted from inexperience of field personnel with flounder gonads. At any rate, spawning of Arctic flounder in Tuktoyaktuk Harbour apparently occurs in mid-winter, as recently spent males and females were captured on 22 March 1981 at Site 12 (Fig. 3). Three spent males ranged in total length from 183 to 258 mm while the lengths of three spent females varied from 231 to 272 mm. On the basis of this information it seems clear that the previously mentioned migration away from the deeper parts of the harbour in late March represented a post-spawning dispersal.

Seventeen Arctic flounder stomachs were examined during the study. Of seven opened in the field, three were empty while the others contained Isopoda (n=2), Amphipoda (n=1), and digested remains (n=1). Ten stomachs examined in the laboratory all contained food (Table 31). The dominance of Pelecypoda, which accounted for 90% of the total food biomass in the sample, was the result of two fish captured at Site 8 on 27 May 1980. None of the other fish examined had consumed molluscs. Amphipoda, which occurred in 70% of the stomachs and Isopoda (40%) were also important dietary items. The diet of Arctic flounder in Tuktoyaktuk Harbour is similar to that reported by Nikolski (1961), Percy (1975), and Jones and den Beste (1977).

Saffron cod: The saffron cod is found in salt and brackish waters of the Arctic coast as far east as Bathurst Inlet or Simpson Strait and readily enters fresh water (Walters 1955). In the southern Beaufort Sea it is found both nearshore and in offshore areas (Percy 1975; Galbraith and Hunter 1975). Although common and reported from many coastal locations this species is apparently not abundant in this area (Kendel et al. 1975; Bray 1975; Riske 1960; Jones and den Beste 1977; Lawrence et al. in prep.).

During the present study 29 saffron cod were captured in Tuktoyaktuk Harbour with 24 (83%) being taken in bottom-set Swedish gillnets. Most of those captured in Swedish nets (54%) were taken at Site 3 (Fig. 3), while others were captured at Sites 5, 6, 7, 8, 12, and at the entrance to Aveltkok Inlet.

Saffron cod ranged in length from 65 to 542 mm (Fig. 36) and, among 12 fish for which age was determined, otolith age varied from 3 to 15 years. Males and females were present in equal numbers (Table 28).

Of 12 fish for which both age and sex were determined only two (both females) were considered to be mature. The youngest mature female was 12 years old. Jones and den Beste (1977) reported that saffron cod aged 5 to 10 years were all expected to spawn in the year of capture.

Saffron cod apparently spawn in Tuktoyaktuk Harbour in March. On 22 March 1981 three female cod (476-503 mm) were captured at Site 12. One of these fish was nearly ripe, one was ripe and running, and the other was spent. Arctic cisco, captured at the same time, were found to have cod eggs in their stomachs. Nikolski (1961) reported that saffron cod spawn during winter in the Soviet Union.

All three saffron cod captured on the spawning grounds were found to have empty stomachs. Of 13 other fish examined eight (62%) had empty stomachs while the remainder had consumed Amphipoda (n=4), fish (n=2), and Isopoda (n=1). Saffron cod are also reported to consume Pelecypoda, Mysidacea, Nematoda, and plant material (Percy 1975).

Burbot: Seven burbot were captured in Tuktoyaktuk Harbour during the present study (Table 5). Five were taken during the winter at Site 3 (n=2), Site 11 (n=1), and Site 6 (n=1), and Site 13 (n=1) while single specimens were captured 9 July at Site 5 and 10 September at Site 30 (Appendices 1 and 3). Total lengths ranged from 355 to 940 mm while otolith ages varied from 6 to 18 years (Table 28). None of the burbot examined was considered capable of spawning at the next spawning season although one fish (female, age 18, 940 mm) had spawned previously. The stomachs of two burbot examined in the field contained the remains of fourhorn sculpin and least cisco.

The burbot is the only freshwater member of the cod family (Gadidae) and is generally distributed throughout North America north of 40°N (Scott and Crossman 1973). Burbot sometimes enter brackish water and have been reported from Herschell Island (Kendel et al. 1975) to Atkinson Point (Galbraith and Hunter 1975) on the Beaufort Sea coast. They appear, however, to be incapable of withstanding very high salinities (Hunter 1975) and usually do not venture far beyond river mouths. Percy (1975) captured burbot throughout the outer Mackenzie Delta but reported them to be absent from the northeast coast of Richard's Island where salinities exceeded 5 $g \cdot L^{-1}$. Spawning is believed to occur during mid-winter in channels of the Mackenzie River (Percy 1975), and shallow, turbid, delta lakes function as nursery areas for the young (de Graaf and Machniak 1977).

Ninespine stickleback: The ninespine stickleback is a euryhaline species with a circumpolar distribution. It is typically found in shallow bays of lakes, slow streams, and tundra ponds, and coastal sticklebacks are often abundant in estuaries (McPhail and Lindsey 1970). Ninespine sticklebacks are common along the Beaufort Sea coast (Kendel et al. 1975; Percy 1975; Griffiths et al. 1975, 1977; Craig and Griffiths 1978; Jones and den Beste 1977) and have been taken as far as 6 km offshore in Kugmallit Bay (Byers and Kashino 1980). The species is abundant in lakes of the Tuktoyaktuk Peninsula (Lawrence et al. in prep.) and throughout the Mackenzie River valley where it is a forage fish of major importance (Stein et al. 1973; Jessop et al. 1973).

Ninespine stickleback accounted for 9.7% of all fish captured during the present study and made up 15.3% of the total catch in small mesh seines (Table 5). During 1980 stickleback were captured at Sites S3 (n=15), S5 (n=5), S6 (n=4), S15 (n=2), S2 (n=5), S1 (n=1), and S4 (n=1). Although present in the harbour throughout the summer they were never abundant except on 26 September 1979, when large numbers were taken at Mayogiak Creek (n=425), Aveltkok Inlet (n=100), and Freshwater Creek (n=50) (Appendix 5). Of all stickleback captured during the study 91.5% were taken on the one day. Other authors have also noted an increased abundance, indicating major movements of ninespine stickleback, in late summer and early autumn (Jessop et al. 1973; de Graaf and Machniak 1977; Fallis et al. in prep.). The latter authors documented a heavy movement of ninespines downstream in Kukjuktuk Creek in late August and September 1979. The large numbers taken on 26 September 1979 near the mouths of Mayogiak and Freshwater creeks probably indicates a similar movement out of lakes of those systems.

Ninespine stickleback captured in Tuktoyaktuk Harbour in 1980 ranged in total length from 25 to 65 mm with the majority (68%) being 30 to 44 mm. No age determinations were performed on these fish; however, Percy (1975) reported fish 25 to 35 mm in total length to be age 0+ while de Graaf and Machniak (1977) indicated length ranges of 26 to 36 mm at age 1 and 44 to 55 mm at age 2. The latter authors reported all age 2 fish to be sexually mature.

Pond smelt: Only 17 pond smelt were captured in Tuktoyaktuk Harbour during the present study (Table 5). These fish ranged in fork length from 37 to 76 mm with a mean length of 63 mm. In 1979 pond smelt were taken at the mouth of Freshwater (n=11) and Mayogiak (n=3) creeks while single specimens were captured at Sites S8, S3, and S2 during 1980.

Pond smelt taken in Tuktoyaktuk Harbour probably originated in lakes of the Freshwater or Mayogiak systems (Fig. 3). This species is common in lakes of Richards Island and the Tuktoyaktuk Peninsula as far east as the Kukjuktuk watershed (Lawrence et al. in prep.) and large downstream migrations are known to occur in late August and September (Fallis et al. in prep.).

Eelpout: A single specimen, identified as *Lycodes jugoricus*, was taken at Site 9 (Fig. 3) on 15 July 1980. This fish was a mature female with a total length of 447 mm and a weight of 475 g (Table 28).

SUMMARY

USE OF TUKTOYAKTUK HARBOUR BY FISH

The results of the present study suggest that Tuktoyaktuk Harbour is a highly complex system in terms of the dynamics of its fish community. A few fish species are year-round residents of the harbour, undertaking only limited movements. Some utilize the harbour on a seasonal basis as an overwintering and/or spawning location. For other species Tuktoyaktuk Harbour appears to be simply a pass-through point on a migration route.

The structure of the fish community of Tuktoyaktuk Harbour varies considerably during the course of the year, primarily as a result of migrations of anadromous coregonids and Pacific herring. Late spring (probably including considerable under-ice movement) and autumn are the periods of most intense migratory movements although such activity continues throughout the summer. Of the ten major species encountered, only Arctic flounder and starry flounder appear to be non-migratory although both species displayed local inshore-offshore movements. Obvious differences were observed between the inshore fauna and that occupying deeper offshore sites during the summer months. Unfortunately, the use of different gear types in these two different habitats precluded realistic comparisons between them. Inshore areas were never fished under ice, leaving unanswered the critical question of winter utilization. The major findings of the study are summarized below.

1. Fifteen fish species, representing eight families, were captured in Tuktoyaktuk Harbour and the adjacent waters of Kugmallit Bay between 25 July 1979 and 23 March 1981.
2. Six anadromous species dominated the catch, accounting for 78.0% of all fish taken in seines and 59.8% of those captured in gillnets. Overall, least cisco (43.8%) and Arctic cisco (26.7%) were the most abundant anadromous species followed by broad whitefish (13.7%), lake whitefish (7.6%), rainbow smelt (5.2%), and inconnu (2.7%).
3. Among the six brackish water or marine species captured, fourhorn sculpin was the most abundant (49.5%) followed by starry flounder (19.1%), Pacific herring (16.1%), Arctic flounder (12.8%),

saffron cod (2.4%), and eelpout (0.1%).

4. Fourhorn sculpin (January), Arctic flounder (March), saffron cod (March), Pacific herring (June), and starry flounder (June-July), all appear to spawn within Tuktoyaktuk Harbour. However, apart from fourhorn sculpin, no (or very few) young-of-the-year were captured for any of these marine species.
5. Although no definite statement is possible regarding the precise location of any spawning site, Arctic flounder, saffron cod, Pacific herring, and perhaps fourhorn sculpin are believed to spawn below the halocline at depths greater than 6 m. Starry flounder and fourhorn sculpin may spawn inshore.
6. There is no evidence that any of the anadromous species spawn in or near Tuktoyaktuk Harbour and most of the fish examined were sexually immature.
7. Tuktoyaktuk Harbour is an important overwintering area for anadromous Arctic cisco and for Pacific herring. During winter both species were more common below the halocline (Sites 3, 7, 9, 12, and 13) than at shallow locations where the water column became fresh throughout (Sites 4, 5, 6, 8, 10, and 11).
8. Pacific herring apparently fed little during the winter months. Arctic cisco, on the other hand, did feed during the winter with Polychaeta being the most important dietary item.
9. The harbour appears, on the basis of the present study, to be relatively less important to other anadromous coregonid species as an overwintering site than it is to Arctic cisco. Representatives of all four species were captured under ice, however.
10. Rainbow smelt do not appear to overwinter in Tuktoyaktuk Harbour.
11. The migratory movements of the six anadromous species, Pacific herring, and fourhorn sculpin were a major feature of the fish fauna in Tuktoyaktuk Harbour and resulted in considerable variation in the species composition during the summer months. In some cases (e.g. Arctic cisco, Pacific herring), Tuktoyaktuk Harbour was the obvious destination (or origin) of the migration while, in others (e.g. broad whitefish, least cisco), it appeared to be just a pass-through point along a migration route. In the latter case catch-per-unit-effort data were difficult to interpret, as migrations in two directions may have been occurring simultaneously.
12. Pacific herring migrated from Kugmallit Bay into Tuktoyaktuk Harbour in large numbers during late summer and autumn. After spawning in late June or early July, they left the harbour to migrate, presumably, to summer feeding areas located offshore. Immature herring appeared to accompany the spawners on these migrations.
13. The large migration of Arctic cisco that entered the Harbour in late summer and autumn consisted primarily of non-spawning fish. Arctic cisco, including some whose gonads had matured over the winter, left the harbour in late June and early July.
14. Broad whitefish, lake whitefish, and least cisco that were large enough to be captured in gillnets were present in Tuktoyaktuk Harbour throughout the ice-free period, but were most abundant in September when, it is believed, they were in the process of migrating from summer feeding areas to overwintering sites. Since large numbers of such fish were not taken in early summer, it was assumed that much of the spring migration from the overwintering areas toward the summer feeding areas passed Tuktoyaktuk under ice-cover.
15. Most broad whitefish, lake whitefish, and least cisco examined during the study had little or no food in their stomachs. This fact is viewed as supporting the opinion that these fish were in the process of migration at the time of capture.
16. Large numbers of young-of-the-year Arctic cisco entered Tuktoyaktuk Harbour in mid-July. Catch-per-unit-effort for these small fish decreased in late summer but at least small numbers appear to remain in the harbour over winter.
17. A large migration of young-of-the-year least cisco entered the harbour in late July. The relative abundance of these small fish decreased through late summer although at least small numbers appear to overwinter within the harbour.
18. Young broad whitefish and lake whitefish were captured only in small numbers. Most were taken near the mouth of Freshwater and Mayogiak creeks, suggesting that these streams may be important as nursery areas for these species.
19. Catch-per-unit-effort data suggest a migration of inconnu out of Tuktoyaktuk Harbour in early summer and a gradual return to the harbour later in the year.
20. Rainbow smelt were present in Kugmallit Bay by mid-July but were abundant inside the harbour only in late August and early September.

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Table 1. Particle size distribution in sediments taken from several locations in Tuktoyaktuk Harbour, 11-12 September 1980.

Location	Depth (m)	Percentage Composition by Weight for each Particle Size[a]										Total Weight of Sample (g)
		Cobble	Pebble	Granule	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay	
TB1	3.0	-	0.91	-	0.28	1.88	0.19	4.00	10.76	81.99[b]		80.00
TB2	2.0	-	21.44	1.07	0.99	5.91	32.27	11.98	6.29	20.45[b]		341.36
TB3	4.0	-	-	-	-	-	-	0.15	1.73	37.85	58.23	61.28
TB4	7.0	-	-	-	-	-	0.04	-	1.61	98.35[b]		90.82
TB5	12.0	-	-	-	-	0.09	0.08	0.20	0.59	30.85	66.11	96.97
TB6	2.5	8.55	18.45	2.30	-	-	11.53	13.74	13.79	20.21	11.43	512.61
TB7	4.0	-	0.78	0.38	0.47	0.80	0.70	30.23	12.95	38.00	14.50	91.77
TB8	7.0	-	-	-	-	-	-	-	-	21.99	74.52	53.50
TB9	2.0	-	2.63	-	-	-	-	0.16	0.54	52.74	41.48	102.10
TB10	5.0	-	3.88	1.88	0.30	0.40	1.28	25.67	21.01	26.86	17.47	101.25
TB11	2.0	-	-	0.09	0.22	0.51	5.37	12.61	10.22	29.14	39.47	146.80
TB12	3.5	-	-	-	-	-	-	-	1.30	27.05	69.35	126.75
TB13	8.0	-	-	-	-	-	-	-	-	25.19	74.16	100.86
TB14	11.0	-	-	-	-	0.06	-	0.14	0.48	24.18	73.04	124.34
TB15	2.0	-	-	-	-	-	-	-	-	34.71	62.65	67.16
TB16	4.0	-	1.69	0.58	0.09	0.08	0.07	0.19	2.52	40.80	53.85	128.03
TB17	2.0	-	-	-	-	-	-	-	-	32.83	62.62	91.80
TB18	2.0	-	-	-	-	-	-	0.14	0.38	49.75	48.81	140.32
TB19	3.7	-	-	-	-	-	-	-	1.48	38.56	56.15	68.75
TB20	2.0	-	-	-	-	-	-	0.79	0.91	40.36	54.66	42.99
TB21	2.0	-	-	-	-	-	-	-	1.37	56.13	40.74	78.35
TB22	2.0	-	-	-	-	-	-	-	0.42	37.89	58.70	57.13
TB23	4.0	-	-	-	-	-	-	-	0.22	46.99	53.12	73.86
TB24	9.0	-	-	-	-	-	-	0.39	3.55	96.05[b]		155.36

[a]The sum of the percentage is usually slightly less than 100% because small amounts of sediment were lost during the sieving process.

[b]These values include both the clay and silt components.

Table 2. Organic content of sediments taken from several locations in Tuktoyaktuk Harbour, 11-12 September 1980.

Location	Depth (m)	First Determination: Sample Wt. (g)	First Determination: Organic Content (%)	Second Determination: Sample Wt. (g)	Second Determination: Organic Content (%)	Combined Samples: Sample Wt. (g)	Combined Samples: Organic Content (%)
TB1	3.0	3.0125	10.99	2.7889	10.94	5.8014	10.96
TB2	2.0	2.8284	3.98	2.5539	3.72	5.3823	3.86
TB3	4.0	2.9859	11.06	2.9636	11.42	5.9495	11.24
TB4	7.0	2.8238	9.92	2.7579	10.06	5.5817	9.99
TB5	12.0	2.7047	10.12	2.7951	9.73	5.4998	9.92
TB6	2.5	2.5423	6.70	2.9981	8.29	5.5404	7.56
TB7	4.0	2.9709	9.10	2.5240	9.18	5.4949	9.14
TB8	7.0	3.7951	40.83	1.9971	5.63	5.7922	28.70
TB9	2.0	3.1819	13.11	2.5915	13.27	5.7734	13.18
TB10	5.0	3.3374	7.81	3.3308	7.45	6.6682	7.63
TB11	2.0	3.8070	8.00	3.2772	7.75	7.0842	7.88
TB12	3.5	3.2489	10.55	3.3054	10.49	6.5543	10.52
TB13	8.0	3.9166	10.45	2.8822	10.47	6.7988	10.46
TB14	11.0	3.4847	10.71	3.4104	10.69	6.8951	10.70
TB15	2.0	3.2884	12.74	3.0323	13.14	6.3207	12.93
TB16	4.0	4.4115	11.32	4.8593	11.44	9.2708	11.39
TB17	2.0	2.6522	10.68	3.0264	10.60	5.6786	10.64
TB18	2.0	3.4548	13.03	2.8768	13.56	6.3316	13.27
TB19	3.7	2.6085	13.96	2.9389	13.79	5.5474	13.87
TB20	2.0	3.1573	17.85	3.0195	17.86	6.1768	17.86
TB21	2.0	2.3066	13.66	2.8123	13.69	5.1189	13.67
TB22	2.0	5.0074	13.87	3.8795	10.81	8.8869	10.83
TB23	4.0	3.9994	8.75	2.8744	8.82	6.8738	8.78
TB24	9.0	2.9261	10.50	2.7207	10.49	5.6468	10.50

Table 3. Number of animals captured by Ekman dredge at each sampling location in Tuktoyaktuk Harbour, 11-12 September 1980.

Taxa	Number of Organisms by Station												Total	
	TB4	TB5	TB7	TB10	TB11	TB12	TB13	TB14	TB16	TB19	TB22	TB24	N	%
Mysidacea					1					1			2	0.05
Amphipoda	4		6	13	10	15	4	1	4				57	1.52
Ostracoda	13	22		146		14			25	2			222	5.93
Copepoda								1			1		2	0.05
Isopoda			1	1			1						3	0.08
Gastropoda	3	1					9	8					21	0.56
Pelecypoda	2		230	187	3	7	2			16			447	11.94
Polychaeta	112	233	216	78	12	8	1244	658	116	20		46	2743	73.26
Oligochaeta		9	32	58	7	7				8	22		143	3.82
Priapulida		3			1					4		1	9	0.24
Nematoda		16	5	1	6	1	1	21		1	37	1	90	2.40
Chironomidae		1											1	0.03
Anthozoa		3			1								4	0.11
Foraminifera	96	220	5	>3300	1	384	251	248	>3400	420		717		
Total[a]	134	288	490	484	41	52	1261	689	145	52	60	48	3744	
Depth (m)	7	12	4	5	2	3.5	8	11	4	3.7	2	9		

[a]Total exclusive of Foraminifera.

Table 4. Scientific and common names of fishes[a] captured in the vicinity of Tuktoyaktuk Harbour during 1979 and 1980.

Family and Generic Name	Common Name	Code
Family Clupeidae		
Clupea harengus pallasi Valenciennes	Pacific herring	PCHR
Family Salmonidae		
Coregonus autumnalis (Pallas)	Arctic cisco	ARCS
Coregonus sardinella Valenciennes	Least cisco	LSCS
Coregonus clupeaformis (Mitchill)	Lake whitefish	LKWT
Coregonus nasus (Pallas)	Broad whitefish	BDWT
Stenodus leucichthys (Guldenstadt)	Inconnu	INCO
Family Osmeridae		
Osmerus mordax (Mitchill)	Rainbow smelt	RNSM
Hypomesus olidus (Pallas)	Pond smelt	PDSM
Family Gadidae		
Lota lota (Linnaeus)	Burbot	BRBT
Eleginus gracilis (Tilesius)	Saffron cod	SFCD
Family Zoarcidae		
Lycodes jugoricus Knipowitsch	Shulupaoluk	ELPT
Family Gasterosteidae		
Pungitius pungitius (Linnaeus)	Ninespine stickleback	NSSB
Family Cottidae		
Myoxocephalus quadricornis (Linnaeus)	Fourhorn sculpin	FHSC
Family Pleuronectidae		
Liopsetta glacialis (Pallas)	Arctic flounder	ARFL
Platichthys stellatas (Pallas)	Starry flounder	STFL

[a]From Robins et al. (1980).

Table 5. Number of fish taken by each capture method in Tuktoyaktuk Harbour between July 1979 and March 1981.

	Gillnets (22.9 m)				Survey Nets		Seines		Total	
	51 mm		70 mm							
	N	%	N	%	N	%	N	%	N	%
Broad whitefish	506	53.7	9	30.0	63	4.3	84	2.0	662	9.8
Lake whitefish	137	14.5	1	3.3	102	6.9	125	2.9	365	5.4
Arctic cisco	39	4.1	0	-	202	13.7	1057	24.6	1298	19.2
Least cisco	2	0.2	2	6.7	168	11.4	1940	45.1	2112	31.3
Inconnu	77	8.2	3	10.0	48	3.3	3	0.1	131	1.9
Pacific herring	-	-	-	-	184	12.5	8	0.2	192	2.8
Rainbow smelt	8	0.9	-	-	95	6.4	148	3.4	251	3.7
Pond smelt	-	-	-	-	-	-	17	0.4	17	0.3
Saffron cod	2	0.2	-	-	24	1.6	3	0.1	29	0.4
Starry flounder	54	5.7	8	26.7	153	10.4	13	0.3	228	3.4
Arctic flounder	24	2.6	6	20.0	93	6.3	29	0.7	152	2.3
Fourhorn sculpin	92	9.8	1	3.3	335	22.7	162	3.8	590	8.7
Burbot	1	0.1	-	-	6	0.4	-	-	7	0.1
Eelpout	-	-	-	-	1	0.1	-	-	1	<0.1
Ninespine stickleback	-	-	-	-	-	-	657	15.3	657	9.7
Unidentified Cisco	-	-	-	-	-	-	10	0.2	10	0.1
Unidentified Osmeridae	-	-	-	-	-	-	46	1.1	46	0.7
Total	942		30		1474		4302		6748	

Table 6. Age-length[a] relationship for broad whitefish captured in Tuktoyaktuk Harbour, 1980.

Scale Age	Males				Females				Combined				Sex Unknown	t Test
	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range		
0+	-	-	-	-	-	-	-	-	17[b]	60	15.1	34- 82	17	-
1	-	-	-	-	-	-	-	-	17[c]	116	23.0	90-166	17	-
2	1	213	-	-	-	-	-	-	2[c]	212	2.1	210-213	1	-
3	1	270	-	-	-	-	-	-	1	270	-	-	-	-
4	4	341	12.9	321-359	9	328	34.3	262-366	15	330	29.4	262-366	2	0.6845
5	18	355	30.1	282-421	15	343	29.7	269-399	33	349	30.0	269-421	-	1.1160
6	19	374	25.2	344-440	13	369	20.8	311-392	33	370	27.0	290-440	1	0.5846
7	45	403	25.8	337-468	41	395	19.9	361-445	86	399	23.3	337-468	-	1.4386
8	77	413	23.2	365-484	63	414	21.6	378-460	141	413	22.4	365-484	1	0.5043
9	70	423	19.4	385-468	48	425	20.4	395-479	118	424	19.7	385-479	-	0.3387
10	26	448	34.5	394-520	30	435	27.2	378-517	56	441	31.3	378-520	-	0.9492
11	9	476	33.9	410-510	15	448	31.1	409-498	24	458	34.3	409-510	-	2.0396
12	1	463	-	-	-	-	-	-	1	463	-	-	-	-
13	2	496	48.1	462-530	3	490	31.3	462-524	5	493	32.8	462-530	-	-
Totals	273				237				549				39	

[a]Fork length (mm).

[b]Captured in seines between 10 July and 19 August, 1980.

[c]Includes fish captured in 1979.

Table 7. Age-specific sex ratios, maturity, and condition factors (K) for broad whitefish captured in Tuktoyaktuk Harbour, 1980.

Scale Age	Males			Females			Combined			F/M Ratio	Sex Unknown	X^2
	n	% Mat	K	n	% Mat	K	n	% Mat	K			
0+	-	-	-	-	-	-	17	0.0	-	-	17	-
1	-	-	-	-	-	-	17	0.0	-	-	17	-
2	1	0.0	-	-	-	-	2	0.0	-	-	1	-
3	1	0.0	1.27				1	0.0	1.27	-	-	-
4	4	0.0	1.42	9	0.0	1.42	15	0.0	1.43	2.25	2	1.23
5	18	0.0	1.45	15	0.0	1.45	33	0.0	1.46	0.83	-	0.27
6	19	0.0	1.40	13	0.0	1.38	33	0.0	1.39	0.68	1	1.13
7	45	0.0	1.41	41	2.4	1.40	86	1.2	1.40	0.91	-	0.19
8	77	3.9	1.43	63	3.2	1.42	141	3.6	1.42	0.82	1	1.40
9	70	2.9	1.43	48	8.3	1.43	118	5.1	1.43	0.69	-	4.10[a]
10	26	3.9	1.52	30	23.3	1.51	56	14.3	1.51	1.15	-	0.29
11	9	0.0	1.50	15	26.7	1.54	24	16.7	1.53	1.67	-	1.50
12	1	0.0	1.46	-	-	-	1	0.0	1.46	-	-	-
13	2	0.0	1.40	3	33.3	1.48	5	20.0	1.45	1.50	-	-
Totals	273			237			549			0.87	39	2.54

[a]Significant difference (P<0.05) between numbers of males and females observed and expected for a sex ratio of unity.

Table 8. Food of broad whitefish captured in Tuktoyaktuk Harbour during 1979 and 1980.

Food Item	Occurrence N	Occurrence %[a]	Biomass Dry Wt (g)	Biomass %
Insecta				
Chironomidae	29	59.18	0.13	1.31
Other Diptera	2	4.08	<0.01	-
Trichoptera	1	2.04	<0.01	-
Insect Remains	1	2.04	<0.01	-
Crustacea				
Amphipoda	6	12.24	0.01	0.10
Mysidacea	1	2.04	<0.01	-
Isopoda	1	2.04	<0.01	-
Copepoda	2	4.08	<0.01	-
Ostracoda	1	2.04	<0.01	-
Conchostraca	1	2.04	0.25	2.51
Notostraca	1	2.04	0.03	0.30
Mollusca				
Pelecypoda	21	42.86	0.50	5.02
Gastropoda	4	8.16	2.57	25.80
Annelida				
Oligochaeta	4	8.16	0.04	0.40
Arachnida				
Acarina	1	2.04	<0.01	-
Priapulida	3	6.12	0.02	0.20
Nematoda	2	4.08	<0.01	-
Cestoda	1	2.04	<0.01	-
Acanthocephala	1	2.04	<0.01	-
Foraminifera	1	2.04	<0.01	-
Plant Remains	36	73.47	2.28	22.89
Unidentified Remains	36	73.47	4.13	41.47
Sand, Stones, etc.	11	22.45	0.89	-
No. Stomachs Examined	59			
No. Stomachs With Food	49			
Total Dry Weight Biomass (g)			9.96	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

Table 9. Age-length[a] relationship for lake whitefish captured in Tuktoyaktuk Harbour, 1980[b].

Scale Age	Males				Females				Combined				Sex Unknown	t Test
	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range		
0+	-	-	-	-	-	-	-	-	3	58	10.0	48- 68	3	-
1	-	-	-	-	-	-	-	-	10	122	18.5	98-154	10	-
2	1	155	-	-	-	-	-	-	4	149	12.3	135-163	3	-
3	3	173	13.7	161-188	5	178	14.8	155-195	21	174	16.9	141-222	13	-
4	4	207	7.4	197-215	5	207	10.0	194-220	13	204	14.0	167-220	4	-
5	6	257	20.5	236-294	5	222	31.1	186-257	13	240	27.8	186-294	2	-
6	9	290	46.4	257-385	1	289	-	-	12	282	44.3	230-385	2	-
7	9	334	41.7	253-393	6	297	50.1	240-367	16	316	47.6	240-393	1	1.554
8	9	344	33.7	275-405	5	331	33.5	274-360	15	336	33.3	274-405	1	0.696
9	8	351	23.4	305-375	13	347	34.3	280-394	22	346	31.1	280-394	1	0.266
10	9	374	14.5	350-391	8	370	22.6	337-410	17	373	18.3	337-410	-	0.447
11	18	383	23.6	350-420	11	377	20.5	346-413	29	381	22.3	346-420	-	0.710
12	10	389	18.9	350-417	18	394	24.5	338-435	28	392	22.4	338-435	-	0.558
13	9	411	19.1	379-440	8	422	29.9	373-476	17	416	24.6	373-476	-	0.933
14	2	428	7.1	423-433	1	406	-	-	3	421	13.7	406-433	-	-
15	2	407	18.4	394-420	3	432	28.1	403-459	5	422	25.9	394-459	-	-
16	-	-	-	-	2	413	6.4	408-417	2	413	6.4	408-417	-	-
Total	99				91				230				40	

[a]Fork length (mm).

[b]1979 and 1980 data were combined in age groups 2 to 6 inclusive.

Table 10. Age-specific sex ratios, maturity, and condition factors (K) for lake whitefish captured in Tuktoyaktuk Harbour, 1980[a].

Scale Age	Males			Females			Combined			F/M Ratio	Sex Unknown	X^2
	n	% Mat	K	n	% Mat	K	n	% Mat	K			
0+	-	-	-	-	-	-	3	0.0	-	-	3	-
1	-	-	-	-	-	-	10	0.0	-	-	10	-
2	1	0.0	0.97	-	-	-	4	0.0	0.98	-	3	-
3	3	0.0	0.97	5	0.0	1.07	21	0.0	1.06	1.67	13	-
4	4	0.0	1.05	5	0.0	1.10	13	0.0	1.08	1.25	4	-
5	6	0.0	1.23	5	0.0	1.25	13	0.0	1.25	0.83	2	-
6	9	0.0	1.34	1	0.0	0.90	12	0.0	1.30	0.11	2	-
7	9	0.0	1.46	6	0.0	1.48	16	0.0	1.47	0.67	1	0.60
8	9	22.2	1.43	5	0.0	1.38	15	13.3	1.40	0.56	1	1.14
9	8	0.0	1.40	13	0.0	1.36	22	9.1	1.37	1.63	1	1.19
10	9	0.0	1.41	8	12.5	1.49	17	5.9	1.45	0.89	-	1.00
11	18	0.0	1.40	11	18.2	1.45	29	6.9	1.42	0.61	-	1.69
12	10	0.0	1.43	18	11.1	1.46	28	7.1	1.45	1.80	-	2.29
13	9	0.0	1.38	8	25.0	1.38	17	11.8	1.51	0.89	-	1.00
14	2	0.0	1.45	1	0.0	1.49	3	0.0	1.47	0.50	-	-
15	2	0.0	1.28	3	0.0	1.66	5	0.0	1.53	1.50	-	-
16	-	-	-	2	50.0	1.48	2	50.0	1.48	-	-	-
Totals	99			91			230			0.92	40	0.03[b]

[a]1979 and 1980 data were combined in age groups 2 to 6 inclusive.

[b]Based on 1980 data only.

Table 11. Food of lake whitefish captured in Tuktoyaktuk Harbour during 1979 and 1980.

Food Item	Occurrence		Biomass	
	N	%[a]	Dry Wt (g)	%
Insecta				
Chironomidae	3	5.00	<0.01	-
Insect Remains	3	5.00	<0.01	-
Crustacea				
Amphipoda	15	25.00	0.13	4.21
Mysidacea	10	16.67	0.08	2.59
Isopoda	2	3.33	0.06	1.94
Cladocera	1	1.67	<0.01	-
Copepoda	12	20.00	0.06	1.94
Ostracoda	18	30.00	0.04	1.29
Mollusca				
Pelecypoda	15	25.00	0.36	11.65
Gastropoda	2	3.33	0.01	0.32
Annelida				
Polychaeta	1	1.67	<0.01	-
Arachnida				
Acarina	1	1.67	<0.01	-
Nematoda	1	1.67	<0.01	-
Cestoda	2	3.33	<0.01	-
Trematoda	2	3.33	<0.01	-
Acanthocephala	3	5.00	<0.01	-
Foraminifera	2	3.33	<0.01	-
Hydrozoa	2	3.33	0.03	0.97
Eggs	4	6.67	0.03	0.97
Fish Remains	2	3.33	0.22	7.12
Plant Remains	32	53.33	0.52	16.83
Unidentified Remains	35	58.33	1.54	49.84
Miscellaneous	1	1.67	0.01	0.32
Sand, Stones etc.	14	23.33	1.17	-
No. Stomachs Examined	68			
No. Stomachs With Food	60			
Total Dry Weight Biomass (g)			3.09	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

Table 12. Seasonal changes in mean fork length for Arctic cisco captured in Swedish survey-type gillnets in Tuktoyaktuk Harbour, 1980-1981.

	Date of Capture							
	April to May	12-13 June	July	Aug.	4 Sept.[a]	6-7 Sept.	25-26 Sept.[a]	Jan./81 March/81
Mean Fork Length (mm)	305	261	244	-	194	256	316	287
Range	95-383	163-374	107-377	-	111-271	125-397	200-409	163-378
Sample Size	53	22	15	0	23	67	76	29

[a]Data from Byers and Kashino (1980).

Table 13. Age-length[a] relationship for Arctic cisco captured in Tuktoyaktuk Harbour, 1980.

Scale Age	Males n	Males Mean	Males SD	Males Range	Females n	Females Mean	Females SD	Females Range	Combined n	Combined Mean	Combined SD	Combined Range	Sex Unknown	t Test
0+	-	-	-	-	-	-	-	-	50[b]	35	4.3	27- 46	50	-
1	-	-	-	-	-	-	-	-	50[c]	94	16.5	74-123	50	-
2	-	-	-	-	3	195	25.5	173-223	8	188	18.5	170-223	5	-
3	6	212	17.0	195-238	13	211	23.5	170-264	28	202	23.3	160-264	9	0.113
4	8	253	24.0	216-288	5	240	33.7	192-278	17	237	31.9	181-288	4	0.822
5	8	286	22.5	245-325	10	268	29.2	223-300	20	273	29.9	208-325	2	1.400
6	4	282	50.0	213-332	13	323	44.8	280-407	18	312	47.0	213-407	1	1.571
7	13	333	29.6	298-382	16	376	38.9	290-430	30	356	40.4	290-430	1	3.319[d]
8	16	369	26.1	325-402	21	368	37.9	288-421	37	369	32.9	288-421	-	0.077
9	2	360	14.1	350-370	17	372	24.0	341-410	19	370	23.1	341-410	-	-
10	-	-	-	-	3	379	14.4	363-391	3	379	14.4	363-391	-	-
11	-	-	-	-	1	480	-	-	1	480	-	-	-	-
Totals	57				102				281				122	

[a]Fork length (mm).
[b]Captured in seines 10 July, 1980.
[c]Captured in seines between 8 and 23 July, 1980.
[d]Significant difference between means for males and females (P<0.01).

Table 14. Age-specific sex ratios, maturity, and condition factor (K) for Arctic cisco captured in Tuktoyaktuk Harbour, 1980.

Scale Age	Males n	Males % Mat	Males K	Females n	Females % Mat	Females K	Combined n	Combined % Mat	Combined K	F/M Ratio	Sex Unknown	X^2
0+	-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	1	0.0	0.82	3	0.0	0.77	-	2	-
2	-	-	-	3	0.0	1.10	8	0.0	1.03	-	5	-
3	6	0.0	1.13	13	0.0	1.05	28	0.0	1.04	2.17	9	1.32
4	8	0.0	1.10	5	0.0	1.12	17	0.0	1.10	0.63	4	0.69
5	8	0.0	1.12	10	0.0	1.05	20	0.0	1.09	1.25	2	0.22
6	4	0.0	1.43	13	23.1	1.23	18	16.7	1.27	3.25	1	3.76
7	13	0.0	1.17	16	37.5	1.30	30	20.0	1.26	1.23	1	0.31
8	16	12.5	1.20	21	42.9	1.28	37	24.3	1.25	1.31	-	0.68
9	2	0.0	1.21	17	17.7	1.27	19	15.8	1.27	8.50	-	10.32[a]
10	-	-	-	3	66.7	1.19	3	66.7	1.19	-	-	-
11	-	-	-	1	100.0	1.13	1	100.0	1.13	-	-	-
Totals	57			103			184			1.81	24	13.23[a]

[a]Significant difference between numbers of males and females observed and expected for a sex ratio of unity (P<0.01).

Table 15. Food of Arctic cisco captured in Tuktoyaktuk Harbour during 1980.

Food Item	Occurrence		Biomass	
	N	%[a]	Dry Wt (g)	%
Crustacea				
Amphipoda	27	40.30	0.21	4.08
Mysidacea	2	2.99	0.01	0.19
Isopoda	1	1.49	<0.01	-
Copepoda	5	7.46	1.32	25.63
Ostracoda	3	4.48	0.01	0.19
Mollusca				
Pelecypoda	2	2.99	0.01	0.19
Gastropoda	2	2.99	<0.01	-
Annelida				
Polychaeta	20	29.85	2.64	51.26
Nematoda	6	8.96	<0.01	-
Trematoda	35	52.24	0.02	0.39
Foraminifera	4	5.97	0.01	0.19
Hydrozoa	2	2.99	<0.01	-
Eggs	3	4.48	0.04	0.78
Fish Remains	3	4.48	0.02	0.39
Plant Remains	23	34.33	0.18	3.50
Unidentified Remains	29	43.28	0.67	13.01
Miscellaneous	1	1.49	0.01	0.19
Sand, Stones, etc.	22	32.84	0.43	-
No. Stomachs Examined	96			
No. Stomachs With Food	67			
Total Dry Weight Biomass (g)			5.15	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

Table 16. Age-length[a] relationship for least cisco captured in Tuktoyaktuk Harbour, 1980.

Scale Age	Males				Females				Combined				Sex Unknown	t Test
	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range		
0+	-	-	-	-	-	-	-	-	50[b]	44	4.0	37- 53	50	-
1	-	-	-	-	-	-	-	-	50[b]	84	8.1	71- 98	50	-
2	1	178	-	-	1	169	-	-	14[c]	141	23.6	120-188	12	-
3	8	192	11.2	172-210	7	191	5.9	187-202	22	187	11.7	163-210	7	0.121
4	11	234	15.9	194-250	11	217	8.6	204-233	26	217	14.7	192-250	4	1.237
5	7	259	20.1	223-285	5	249	17.7	225-272	12	255	19.0	223-285	-	0.899
6	5	286	16.6	263-305	9	288	13.2	270-306	14	288	13.9	263-306	-	0.298
7	4	276	9.0	265-287	3	296	12.7	285-310	7	285	14.6	265-310	-	-
8	1	305	-	-	3	320	40.9	285-365	4	316	34.2	285-365	-	-
Totals	37				39				208				123	

[a]Fork length (mm).

[b]Fish captured in seines between 10 and 31 July.

[c]Includes 10 fish (120-137 mm) captured in seines between 10 and 31 July.

Table 17. Age-specific sex ratios, maturity, and condition factors (K) for least cisco captured in Tuktoyaktuk Harbour, 1980.

Scale Age	Males			Females			Combined			F/M Ratio	Sex Unknown	X^2
	n	% Mat	K	n	% Mat	K	n	% Mat	K			
0+	-	-	-	-	-	-	42	0.0	-	-	42	-
1	-	-	-	-	-	-	45	0.0	-	-	45	-
2	1	0.0	0.71	1	0.0	0.73	4	0.0	0.83	1.00	2	-
3	8	0.0	1.22	7	0.0	1.07	22	0.0	1.12	0.88	7	0.27
4	11	0.0	0.92	11	0.0	0.98	26	0.0	0.93	1.00	4	0.00
5	7	42.9	0.93	5	0.0	0.81	12	25.0	0.89	0.71	-	0.33
6	5	20.0	0.95	9	22.2	0.93	14	21.4	0.94	1.80	-	1.14
7	4	0.0	1.00	3	33.3	0.93	7	14.9	0.97	0.75	-	-
8	1	0.0	1.06	3	33.3	1.04	4	25.0	1.05	3.00	-	-
Totals	37			39			176			1.05	100	0.05

Table 18. Food of least cisco captured in Tuktoyaktuk Harbour during 1979 and 1980.

Food Item	Occurrence		Biomass	
	N	%[a]	Dry Wt (g)	%
Insecta				
Chironomidae	5	17.86	0.01	0.59
Insect Remains	1	3.57	< 0.01	-
Crustacea				
Amphipoda	2	7.14	0.16	9.41
Mysidacea	2	7.14	<0.01	-
Cladocera	1	3.57	<0.01	-
Copepoda	16	57.14	0.91	53.53
Ostracoda	1	3.57	<0.01	-
Crustacean Remains	1	3.57	<0.01	-
Arachnida				
Acarina	4	14.29	0.02	1.18
Nematoda	1	3.57	< 0.01	-
Cestoda	3	10.71	0.02	1.18
Trematoda	5	17.86	< 0.01	-
Foraminifera	1	3.57	<0.01	-
Fish Remains	2	7.14	0.06	3.53
Plant Remains	6	21.43	0.10	5.88
Unidentified Remains	12	42.86	0.42	24.71
Sand, Stones, etc.	3	10.71	0.52	-
No. Stomachs Examined	31			
No. Stomachs With Food	28			
Total Dry Weight Biomass (g)			1.70	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

Table 19. Age-length[a] relationship for inconnu captured in Tuktoyaktuk Harbour, 1980.

Scale Age	Males				Females				Combined				Sex Unknown	t Test
	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range		
0+	[a]	-	-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	1	416	-	-	-	-	-	-	1	416	-	-	-	-
5	3	483	28.8	459-515	8	462	22.7	431-493	12	467	24.0	431-493	1	-
6	6	494	57.6	432-574	14	478	39.8	387-530	24	476	47.7	387-574	4	0.714
7	13	509	28.1	470-548	19	506	26.5	470-580	33	506	27.8	456-580	2	0.272
8	8	540	65.6	440-608	7	552	23.1	522-584	15	546	49.2	440-608	-	0.463
9	4	573	38.8	515-597	5	577	57.3	503-630	9	575	47.0	503-630	-	0.114
10	4	643	32.3	600-674	4	592	26.0	562-620	8	617	38.4	562-674	-	2.448[b]
11	-	-	-	-	2	655	105.4	580-729	2	655	105.4	580-729	-	-
12	1	644	-	-	3	774	56.2	644-821	4	742	79.7	644-821	-	-
13	-	-	-	-	2	879	46.7	846-912	2	879	46.7	846-912	-	-
14	1	685	-	-	-	-	-	-	1	685	-	-	-	-
15	-	-	-	-	1	933	-	-	1	933	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	1	847	-	-	1	847	-	-	-	-
Totals	41				66				114				7	

[a]Fork length (mm).
[b]Significant difference between means for males and females ($P<0.05$).

Table 20. Age-specific sex ratios, maturity, and condition factors (K) for inconnu captured in Tuktoyaktuk Harbour, 1980.

Scale Age	Males			Females			Combined			F/M Ratio	Sex Unknown	X^2
	n	% Mat	K	n	% Mat	K	n	% Mat	K			
0+	-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	1	0.0	0.87	-	-	-	1	0.0	0.87	-	-	-
5	3	0.0	0.86	8	0.0	0.90	12	0.0	0.88	2.67	1	1.45
6	6	0.0	0.88	14	0.0	0.94	24	0.0	0.92	2.33	4	3.20
7	13	0.0	0.91	19	0.0	0.92	33	0.0	0.92	1.46	2	1.13
8	8	0.0	0.97	7	0.0	0.92	15	0.0	0.94	0.88	-	0.07
9	4	0.0	0.96	5	0.0	1.06	9	0.0	1.02	1.25	-	-
10	4	0.0	0.93	4	0.0	1.01	8	0.0	0.97	1.00	-	-
11	-	-	-	2	0.0	1.11	2	0.0	1.11	-	-	-
12	1	0.0	0.95	3	0.0	1.09	4	0.0	1.08	3.00	-	-
13	-	0.0	-	2	0.0	1.09	2	0.0	1.09	-	-	-
14	1	-	1.07	-	-	-	1	0.0	1.07	-	-	-
15	-	-	-	1	0.0	0.88	1	0.0	0.88	-	-	-
16	-	-	-	-	-	-	-	-	-	-		
17	-	-	-	1	-	1.03	1	0.0	1.03	-		
Totals	41			66			114			1.61	7	5.84[a]

[a]Significant difference ($P<0.05$) between numbers of males and females observed and expected for a sex ratio of unity.

Table 21. Age-length[a] relationship for Pacific herring captured in Tuktoyaktuk Harbour, 1980.

Otolith Age	Males				Females				Combined				Sex Unknown	t Test
	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range		
0+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	3	103	2.5	101-106	3	-
3	-	-	-	-	-	-	-	-	1	156	-	-	1	-
4	4	192	9.2	179-201	14	186	14.0	155-201	19	188	13.0	155-201	1	0.704
5	5	191	3.6	187-195	7	186	10.2	172-204	14	190	8.9	172-205	2	1.032
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	1	255	-	-	1	268	-	-	2	262	9.2	255-268	-	-
8	-	-	-	-	2	282	7.8	276-287	2	282	7.8	276-287	-	-
9	2	287	4.9	283-290	1	312	-	-	3	295	15.1	283-312	-	-
10	3	284	8.3	275-291	1	300	-	-	4	288	10.4	275-300	-	-
11	12	284	8.3	270-298	4	293	18.2	270-313	16	286	11.4	270-313	-	1.294
12	7	294	13.7	277-315	4	306	17.8	283-323	11	298	15.5	277-323	-	1.190
13	2	315	4.2	312-318	2	323	13.4	313-332	4	319	9.2	312-332	-	-
14	-	-	-	-	1	320	-	-	1	320	-	-	-	-
15	1	320	-	-	-	-	-	-	1	320	-	-	-	-
Totals	37				37				81				7	

[a]Fork length (mm).

Table 22. Age-specific sex ratios, maturity and condition factors (K) for Pacific herring captured in Tuktoyaktuk Harbour, 1980.

Otolith Age	Males			Females			Combined			F/M Ratio	Sex Unknown	X^2
	n	% Mat	K	n	% Mat	K	n	% Mat	K			
0+	-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	3	0.0	0.91	-	3	-
3	-	-	-	-	-	-	1	0.0	0.76	-	1	-
4	4	0.0	0.85	14	0.0	0.90	19	0.0	0.89	3.50	1	4.50[a]
5	5	0.0	0.99	7	0.0	1.01	14	0.0	1.04	1.40	2	0.33
6	-	-	-	-	-	-	-	-	-	-	-	-
7	1	100.0	1.21	1	0.0	1.04	2	50.0	1.12	1.00	-	-
8	-	-	-	2	100.0	1.12	2	100.0	1.12	-	-	-
9	2	100.0	1.12	1	100.0	1.15	3	100.0	1.14	0.50	-	-
10	3	100.0	1.09	1	100.0	1.30	4	100.0	1.15	0.33	-	-
11	12	90.9	1.19	4	100.0	1.15	16	93.8	1.10	0.33	-	3.06
12	7	100.0	1.16	4	100.0	1.16	11	100.0	1.16	0.57	-	0.82
13	2	100.0	1.28	2	100.0	1.12	4	100.0	1.20	1.00	-	-
14	-	-	-	1	100.0	1.14	1	100.0	1.14	-	-	-
15	1	100.0	1.37	-	-	-	1	100.0	1.37	-	-	-
Totals	37			37			81			1.00	7	

[a]Significant difference ($P<0.05$) between numbers of males and females observed and expected for a sex ratio of unity.

Table 23. Seasonal changes in gonadosomatic index for female Pacific herring in Tuktoyaktuk Harbour.

Date	Sample Size	Fork Length Range (mm)	Gonadosomatic Index	
			Mean	Range
September[a]	15	305 - 338	6.1	4.6 - 7.2
8 January 1981	10	262 - 312	11.4	6.3 - 17.9
20 March 1981	7	265 - 327	13.7	11.7 - 15.2
28 May 1981[b]	15	258 - 309	17.8	14.9 - 21.7
14 June 1981[b]	10	261 - 323	21.7	16.9 - 25.6

[a]Data from Riske (1960).

[b]Data obtained from Mr. D. V. Gillman, Dept. Fisheries and Oceans. Mr. Gillman states that spawning had commenced by 14 June 1981 and that some egg loss had occurred in a few of the fish in the sample for that date.

Table 24. Food of Pacific herring captured in Tuktoyaktuk Harbour between July, 1979 and January, 1981.

Food Item	Occurrence[a]		Biomass	
	N	%	Dry Wt (g)	%
Insecta				
Chironomidae	2	3.39	<0.01	-
Other Diptera	1	1.69	<0.01	-
Insect Remains	3	5.08	<0.01	-
Crustacea				
Amphipoda	4	6.78	0.04	6.45
Mysidacea	3	5.08	0.01	1.61
Copepoda	26	44.07	0.09	14.52
Ostracoda	6	10.17	<0.01	-
Mollusca				
Pelecypoda	1	1.69	<0.01	-
Annelida				
Polychaeta	3	5.08	0.02	3.23
Arachnida				
Acarina	2	3.39	<0.01	-
Trematoda	41	69.49	<0.01	-
Foraminifera	1	1.69	<0.01	-
Eggs	2	3.39	<0.01	-
Plant Remains	19	32.20	<0.01	-
Unidentified Remains	24	40.68	0.46	74.19
Sand, Stones, etc.	17	28.81	<0.01	-
No. Stomachs Examined	105			
No. Stomachs With Food	59			
Total Dry Weight Biomass (g)			0.62	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

Table 25. Age-length[a] relationship for rainbow smelt captured in Tuktoyaktuk Harbour, 1980.

Otolith Age	Males				Females				Combined				Sex Unknown	t Test
	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range		
0+									21[b]	32	3.9	22- 38	21	-
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	1	204	-	-	1	-
5	-	-	-	-	1	201	-	-	1	201	-	-	-	-
6	-	-	-	-	3	221	12.2	210-234	3	221	12.2	210-234	-	-
7	9	233	24.0	193-278	6	248	17.0	230-265	15	239	22.2	193-278	-	1.321
8	9	255	19.1	213-278	4	258	13.5	243-273	13	256	17.1	213-278	-	0.281
9	3	254	27.1	223-270	1	259	-	-	4	256	22.3	223-270	-	-
10	-	-	-	-	5	281	19.6	268-315	5	281	19.6	268-315	-	-
11	-	-	-	-	3	302	42.8	268-350	3	302	42.8	268-350	-	-
Totals	21				23				66				22	

[a]Fork length (mm).
[b]Captured in seines 13 to 19 August, 1980.

Table 26. Age-specific sex ratios, maturity, and condition factors (K) for rainbow smelt captured in Tuktoyaktuk Harbour, 1980.

Otolith Age	Males			Females			Combined			F/M Ratio	Sex Unknown	χ^2
	n	% Mat	K	n	% Mat	K	n	% Mat	K			
0+	-	-	-	-	-	-	21	-	-	-	21	-
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1	-	1.00	-	1	-
5	-	-	-	1	0.0	0.74	1	0.0	0.74	-	-	-
6	-	-	-	3	0.0	0.73	3	0.0	0.73	-	-	-
7	9	55.6	0.75	6	0.0	0.72	15	33.3	0.74	0.67	-	0.60
8	9	66.7	0.79	4	0.0	0.84	13	46.2	0.80	0.44	-	1.23
9	3	33.3	0.83	1	0.0	0.72	4	25.0	0.80	0.33	-	-
10	-	-	-	5	40.0	0.72	5	40.0	0.72	-	-	-
11	-	-	-	3	100.0	0.64	3	100.0	0.64	-	-	-
Totals	21			23			66			1.10	22	0.09

Table 27. Food of rainbow smelt captured in Tuktoyaktuk Harbour during 1980.

Food Item	Occurrence		Biomass	
	N	%[a]	Dry Wt (g)	%
Crustacea				
Amphipoda	5	38.46	0.29	35.80
Mysidacea	4	30.77	0.10	12.35
Isopoda	3	23.08	0.04	4.94
Ostracoda	1	7.69	<0.01	-
Mollusca				
Gastropoda	1	7.69	0.09	11.11
Nematoda	1	7.69	<0.01	-
Trematoda	2	15.38	<0.01	-
Fish Remains	2	15.38	0.09	11.11
Plant Remains	1	7.69	<0.01	-
Unidentified Remains	4	30.77	0.10	12.35
Eggs	3	23.08	0.10	12.35
Sand, Stones, etc.	1	7.69	<0.01	-
No. Stomachs Examined	15			
No. Stomachs With Food	13			
Total Dry Weight Biomass (g)			0.81	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

Table 28. Age-length relationships, age-specific sex ratios, and maturity for other fish species captured in Tuktoyaktuk Harbour, 1979-1980.

Species/Age	Females N	Females %	Females % Mature	Males N	Males %	Males % Mature	Unsexed Fish	Total Sample	Total Length (mm) Mean	Total Length (mm) S.D.	Total Length (mm) Range
Burbot											
6	1	100	-	-	-	-	-	1	615	-	-
8	1	100	-	-	-	-	-	1	530	-	-
10	1	100	-	-	-	-	-	1	620	-	-
12	1	100	-	-	-	-	-	1	640	-	-
18	1	100	-	-	-	-	-	1	940	-	-
Unaged	1	50	-	1	50	-	-	2	-	-	355-655
Totals	6	86	-	1	14	-	-	7	-	-	355-940
Arctic Flounder[a]											
5	2	67	-	1	33	-	-	3	195	45.6	140-231
7	1	100	-	-	-	-	-	1	250	-	-
8	-	-	-	1	100	-	-	1	233	-	-
9	2	50	-	2	50	-	-	4	226	31.6	203-271
10	1	100	-	-	-	-	-	1	275	-	-
11	1	100	-	-	-	-	-	1	304	-	-
12	3	75	-	1	25	-	-	4	253	14.0	215-277
14	1	50	-	1	50	100	-	2	279	25.5	261-297
15	1	50	-	1	50	-	-	2	289	23.3	272-305
18	-	-	-	1	100	-	-	1	261	-	-
20	1	100	-	-	-	-	-	1	314	-	
Unaged	1	50	-	1	50	-	-	121	-	-	29-325
Totals	14	61	-	9	39	11	119	142	-	-	29-325
Starry Flounder[b]											
8	-	-	-	2	100	50	-	2	220	0.7	219-220
9	1	50	-	1	50	100	-	2	246	21.9	230-261
10	1	33	100	2	67	100	-	3	239	4.0	235-243
11	3	27	33	8	73	75	-	11	242	20.0	197-280
12	6	67	33	3	33	33	-	9	256	37.8	224-333
13	3	75	33	1	25	-	-	4	236	15.2	223-257
14	-	-	-	1	100	100	-	1	250	-	-
15	-	-	-	2	100	50	-	2	249	8.5	243-255
17	-	-	-	1	100	-	-	1	252	-	-
18	1	50	100	1	50	100	-	2	249	15.6	238-260
19	-	-	-	3	100	67	-	3	245	13.7	233-260
20	1	50	-	1	50	-	-	2	262	21.9	246-277
21	-	-	-	1	100	100	-	1	263	-	-
22	1	50	-	1	50	-	-	2	273	1.4	272-274
25	-	-	-	1	100	100	-	1	261	-	-
28	-	-	-	1	100	-	-	1	227	-	-
33	-	-	-	1	100	-	-	1	255	-	-
38	1	100	100	-	-	-	-	1	370	-	-
42	1	100	-	-	-	-	-	1	365	-	-
Unaged	7	37	-	12	63	42	159	178			28-344
Totals	26	38	31	43	62	53	159	228	-	-	28-370
Saffron Cod											
3	-	-	-	1	100	-	-	1	285	-	-
8	2	67	-	1	33	-	-	3	362	39.6	327-405
9	-	-	-	2	100	-	-	2	404	3.5	401-406
10	1	100	-	-	-	-	-	1	424	-	-
12	2	67	50	1	33	-	-	3	522	31.8	485-542
13	-	-	-	-	-	-	1	1	470	-	-
15	1	100	100	-	-	-	-	1	500	-	-
Unaged	2	40	-	3	60	-	6	11	-	-	65-530
Totals	8	50	25	8	50	-	7	23	-	-	65-542
Fourhorn Sculpin[c]											
4	1	100	-	-	-	-	2	3	124	74.2	80-210
5	3	100	-	-	-	-	-	3	193	23.7	178-220
6	2	100	-	-	-	-	-	2	186	33.9	162-210
7	6	100	-	-	-	-	-	6	227	40.9	186-304
8	2	100	-	-	-	-	1	3	212	32.1	175-233
9	3	100	-	-	-	-	1	4	258	35.9	222-306
10	4	100	-	-	-	-	1	5	270	34.0	245-330
11	4	100	25	-	-	-	1	5	278	29.5	245-315
12	3	100	33	-	-	-	-	3	296	18.2	275-308
14	1	100	-	-	-	-	-	1	330	-	-
16	1	100	100	-	-	-	-	1	396	-	-
Unaged	10	100	10	-	-	-	178	188	-	-	96-363
Totals	40	100	10	-	-	-	184	224	-	-	80-396
Polar Eelpout											
Unaged	1	100	100	-	-	-	-	1	447	-	-

[a]Includes nine fish captured in 1979.
[b]Includes 30 fish captured in 1979.
[c]Includes 23 fish captured in 1979.

Table 29. Food of fourhorn sculpin captured in Tuktoyaktuk Harbour during 1979 and 1980.

Food Item	Occurrence		Biomass	
	N	%[a]	Dry Wt (g)	%
Crustacea				
Amphipoda	11	52.38	0.92	6.16
Mysidacea	2	9.52	0.03	0.20
Isopoda	15	71.43	3.81	25.52
Ostracoda	1	4.76	<0.01	-
Annelida				
Polychaeta	3	14.29	0.04	0.27
Ascidiacea	1	4.76	0.06	0.40
Nematoda	5	23.81	0.01	0.07
Cestoda	1	4.76	<0.01	-
Trematoda	1	4.76	<0.01	-
Foraminifera	1	4.76	<0.01	-
Hydrozoa	1	4.76	<0.01	-
Eggs	1	4.76	0.02	0.13
Fish Remains	2	9.52	1.60	10.72
Plant Remains	16	76.19	0.74	4.96
Mammal Remains	1	4.76	3.72	24.92
Unidentified Remains	12	57.14	3.98	26.66
Sand, Stones, etc.	4	19.05	0.09	-
No. Stomachs Examined	22			
No. Stomachs With Food	21			
Total Dry Weight Biomass (g)			14.93	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

Table 30. Food of starry flounder captured in Tuktoyaktuk Harbour during 1979 and 1980.

Food Item	Occurrence		Biomass	
	N	%[a]	Dry Wt (g)	%
Insecta				
Chironomidae	1	4.17	<0.01	-
Crustacea				
Amphipoda	16	66.67	0.65	10.76
Isopoda	11	45.83	1.03	17.05
Crustacean Remains	1	4.17	0.02	0.33
Mollusca				
Pelecypoda	7	29.17	2.39	39.57
Annelida				
Polychaeta	3	12.50	0.01	0.17
Oligochaeta	3	12.50	0.01	0.17
Nematoda	3	12.50	0.01	0.17
Cestoda	2	8.33	<0.01	-
Trematoda	1	4.17	<0.01	-
Acanthocephala	3	12.50	<0.01	-
Foraminifera	1	4.17	<0.01	-
Hydrozoa	1	4.17	<0.01	-
Eggs	3	12.50	0.01	0.17
Fish Remains	1	4.17	0.03	0.50
Plant Remains	19	79.17	0.09	1.49
Unidentified Remains	17	70.83	1.79	29.64
Sand, Stones, etc.	4	16.67	0.01	-
No. Stomachs Examined	27			
No. Stomachs With Food	24			
Total Dry Weight Biomass (g)			6.04	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

Table 31. Food of Arctic flounder captured in Tuktoyaktuk Harbour during 1979 and 1980.

Food Item	Occurrence		Biomass	
	N	%[a]	Dry Wt (g)	%
Crustacea				
Amphipoda	7	70.00	0.14	2.37
Isopoda	4	40.00	0.11	1.86
Mollusca				
Pelecypoda	2	20.00	5.31	89.85
Annelida				
Oligochaeta	1	10.00	0.01	0.17
Nematoda	6	60.00	0.01	0.17
Trematoda	1	10.00	<0.01	-
Acanthocephala	1	10.00	<0.01	-
Foraminifera	1	10.00	<0.01	-
Plant Remains	7	70.00	0.02	0.34
Unidentified Remains	6	60.00	0.31	5.25
No. Stomachs Examined	10			
No. Stomachs With Food	10			
Total Dry Weight Biomass (g)			5.91	

[a]Number of occurrences as a percentage of the number of stomachs containing food.

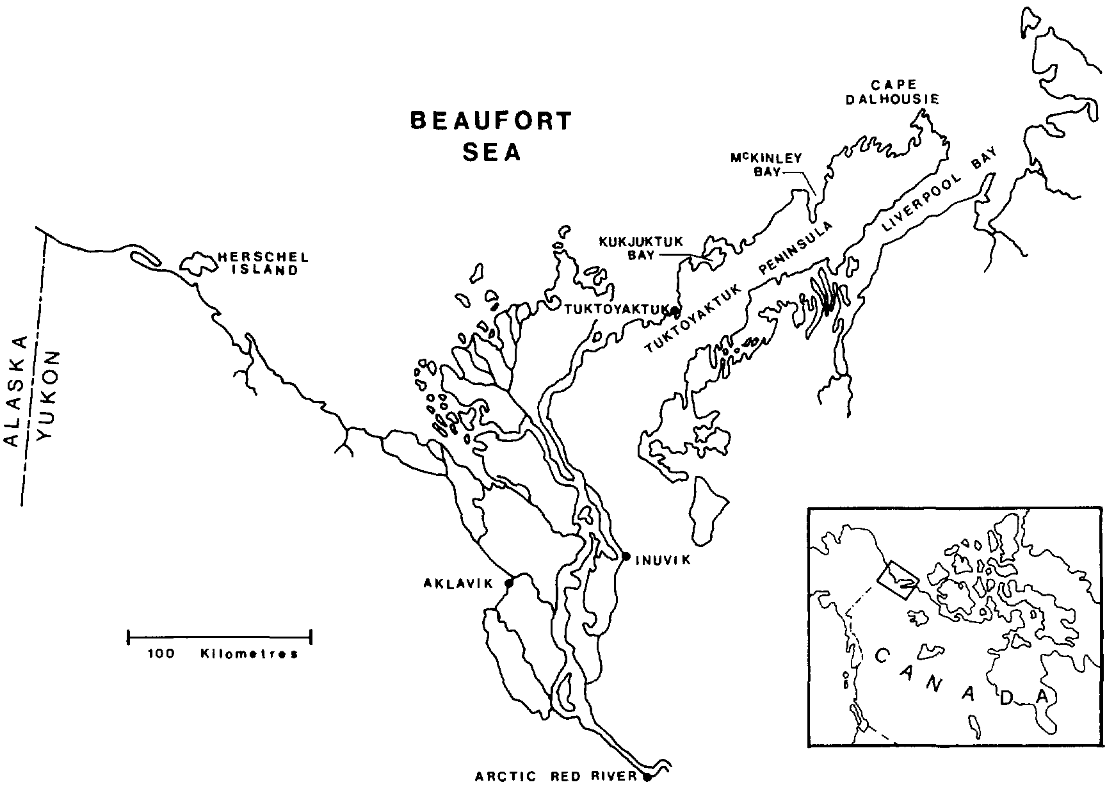

Fig. 1. The Mackenzie Delta-Beaufort Sea Area.

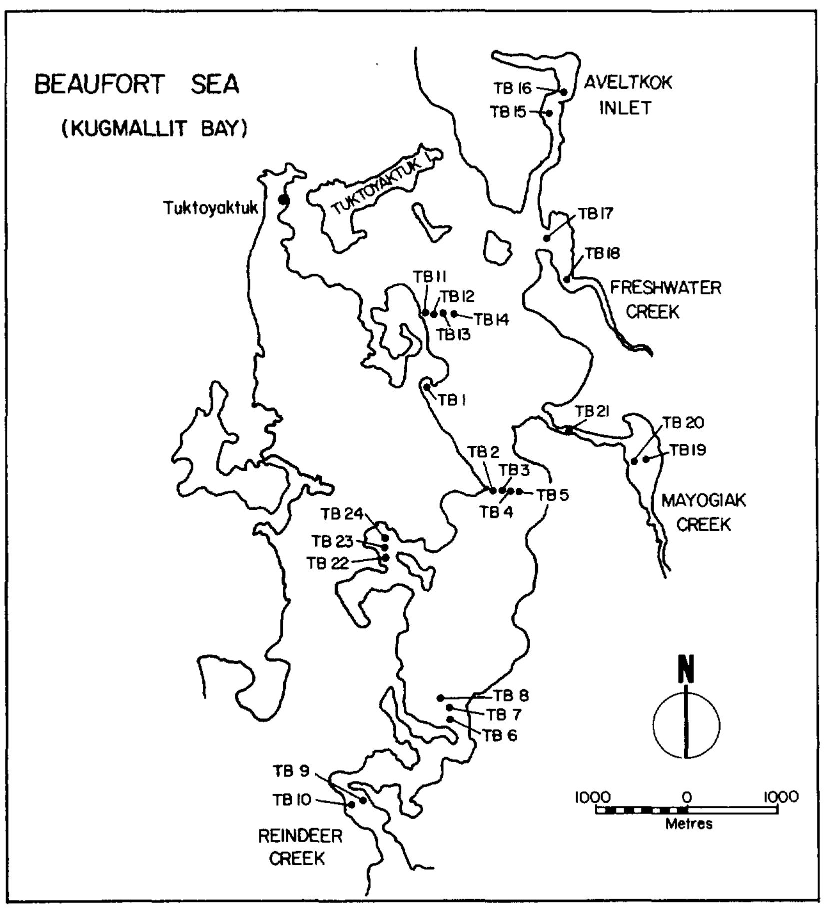

Fig. 2. Tuktoyaktuk Harbour showing location of sites sampled for benthos and bottom sediments.

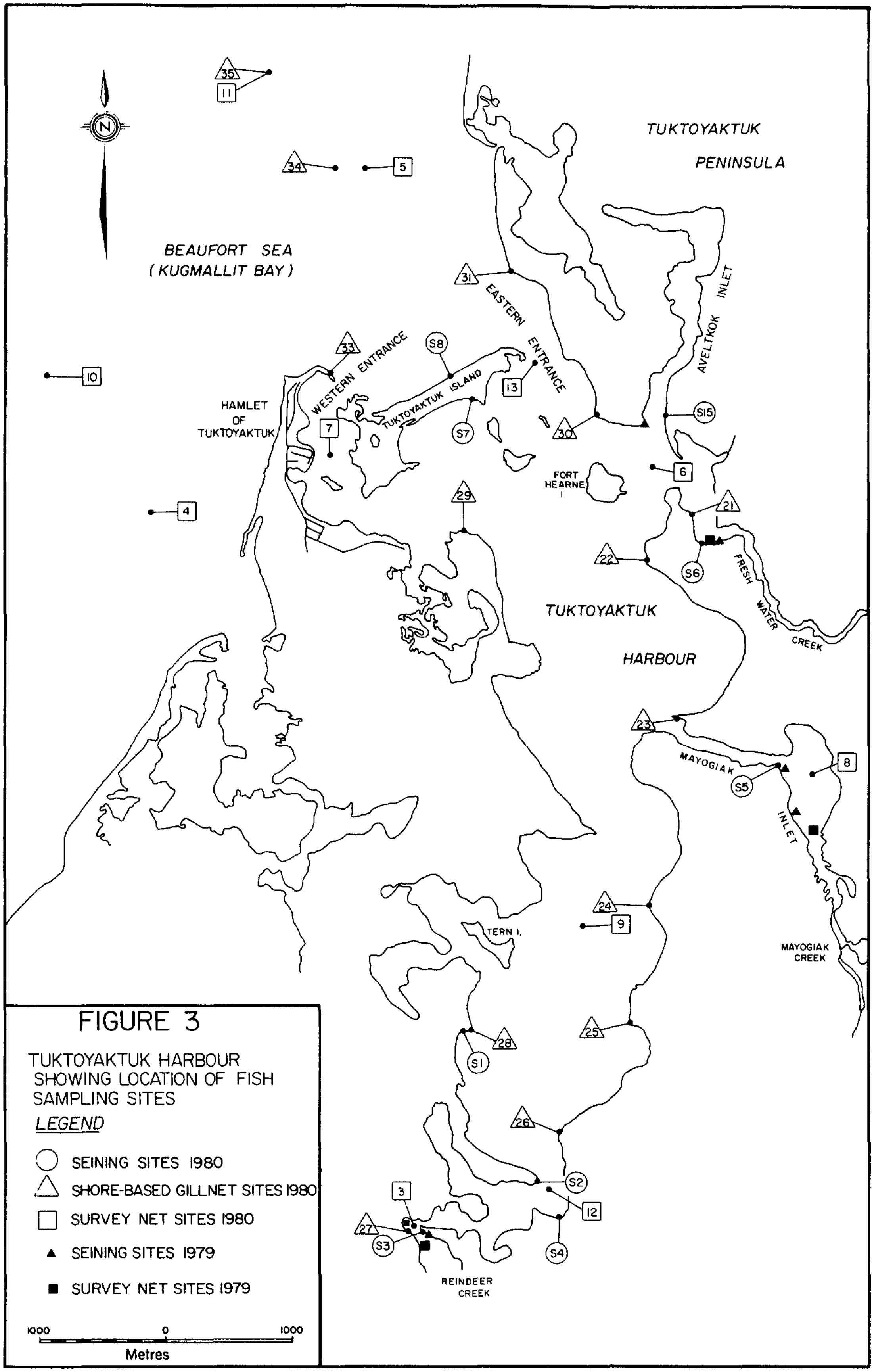

FIGURE 3

TUKTOYAKTUK HARBOUR SHOWING LOCATION OF FISH SAMPLING SITES

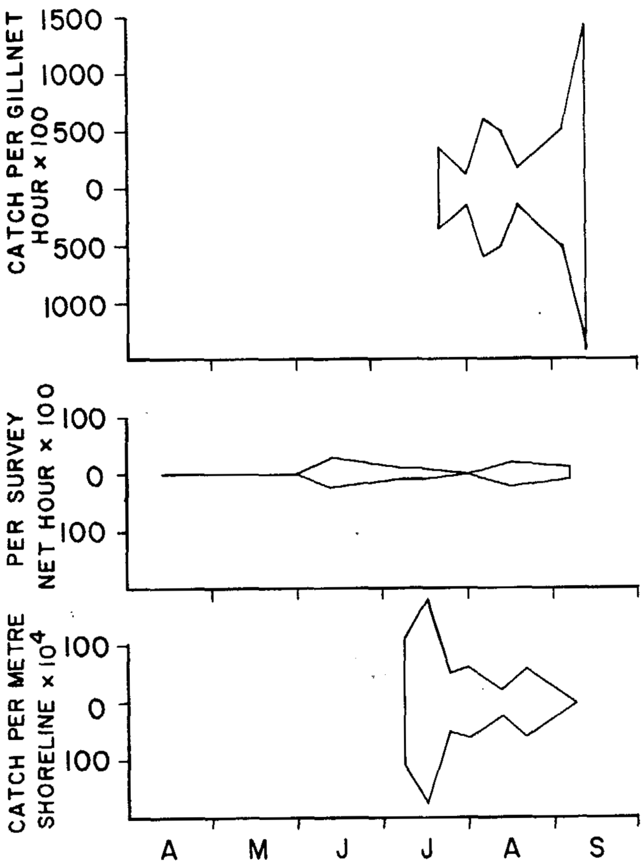

Fig. 4. Seasonal changes in catch-per-unit-effort for broad whitefish captured in gillnets, survey nets, and seines in Tuktoyaktuk Harbour, 1980.

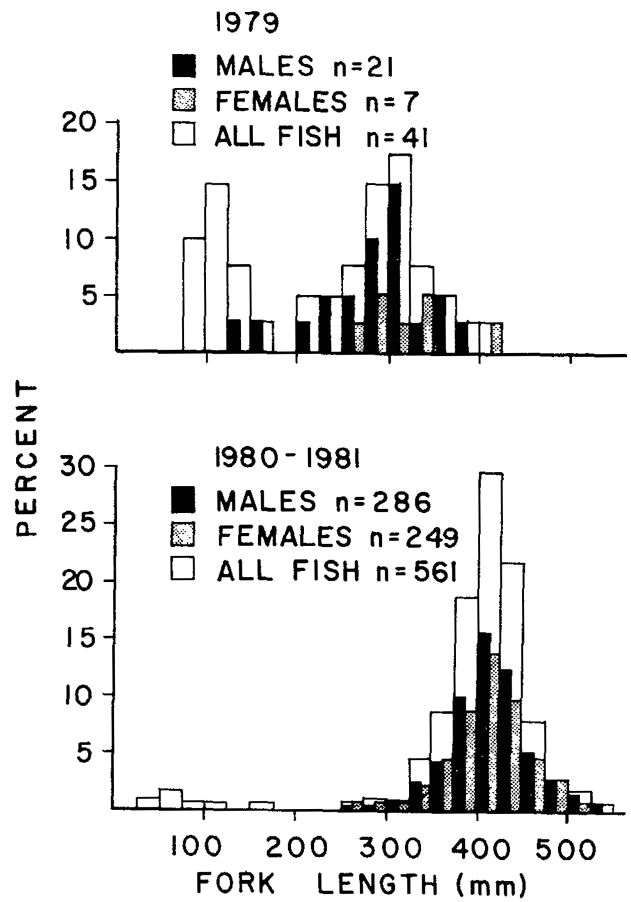

Fig. 5. Length-frequency distribution for broad whitefish captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981.

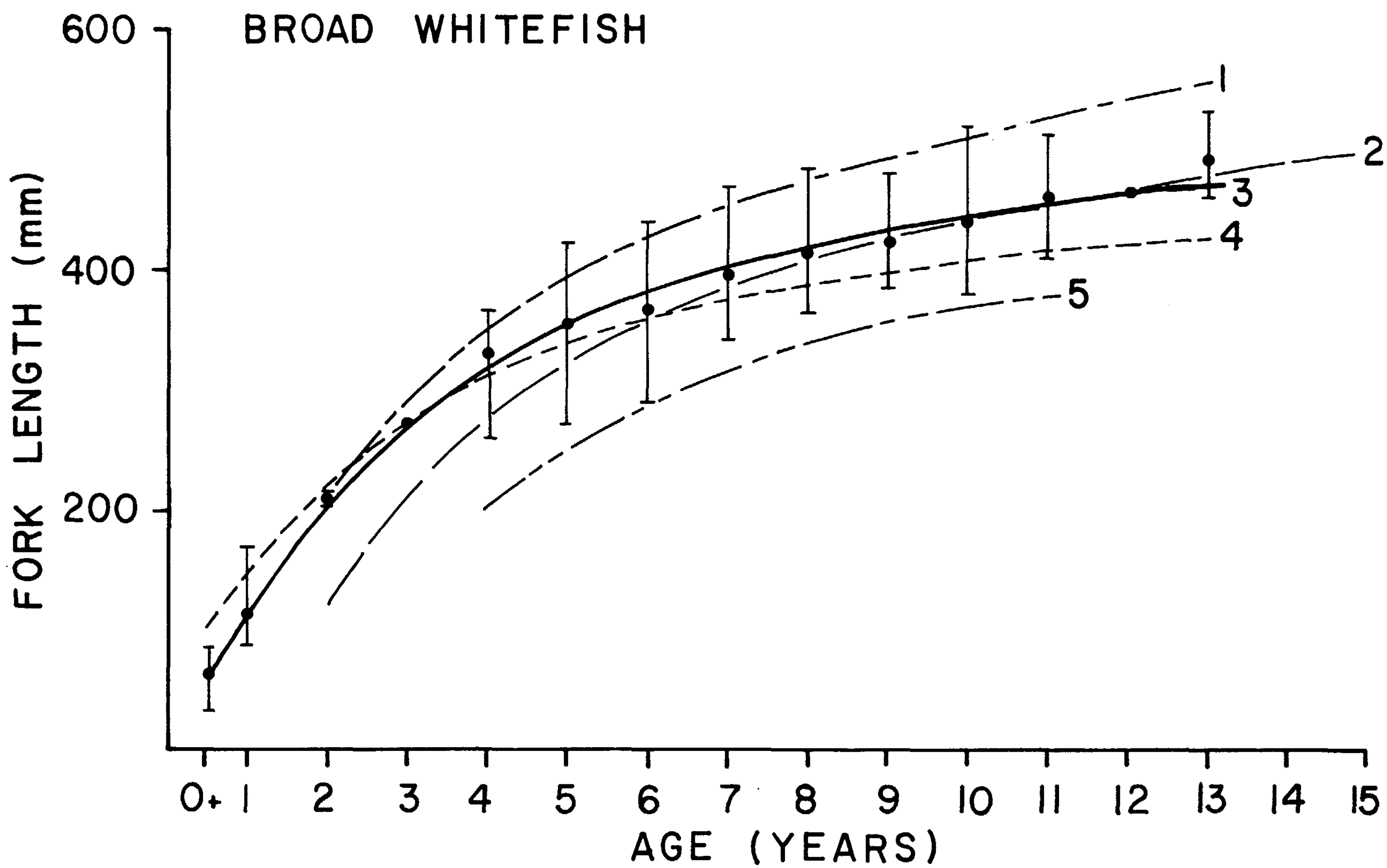

Fig. 6. Comparison of growth rate for broad whitefish from Tuktoyaktuk Harbour with those from several other areas: 1. Mackenzie R. (Hatfield et al. 1972); 2. Mackenzie R. (de Graaf and Machniak 1977); 3. Tuk Harbour (Present Study); 4. Kukjuktuk Cr. (Fallis et al. in prep.); 5. Coppermine R. (Muth 1969).

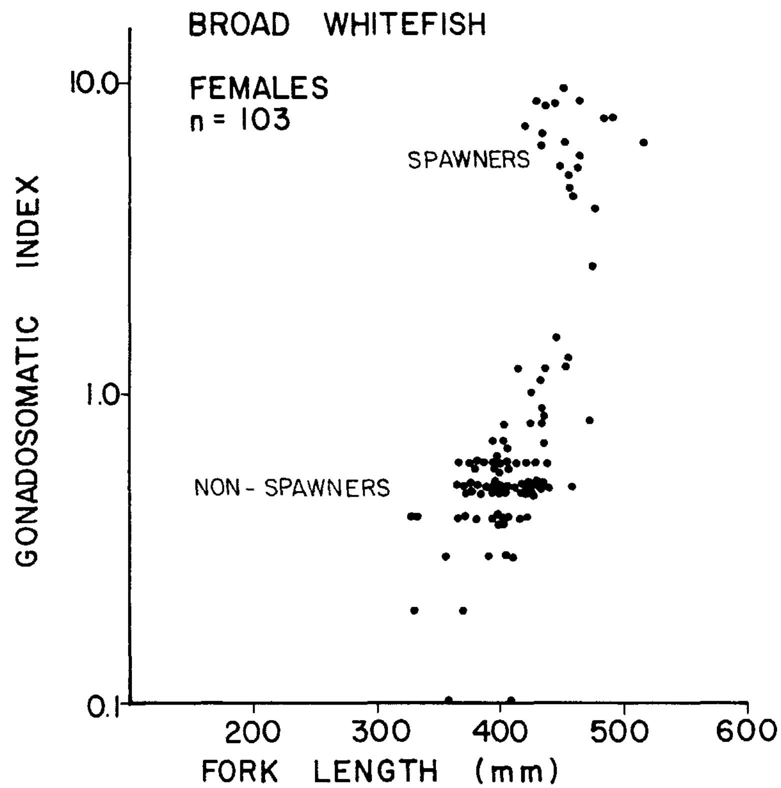

Fig. 7. Gonadosomatic index vs fork length for female broad whitefish captured in Tuktoyaktuk Harbour, 1980.

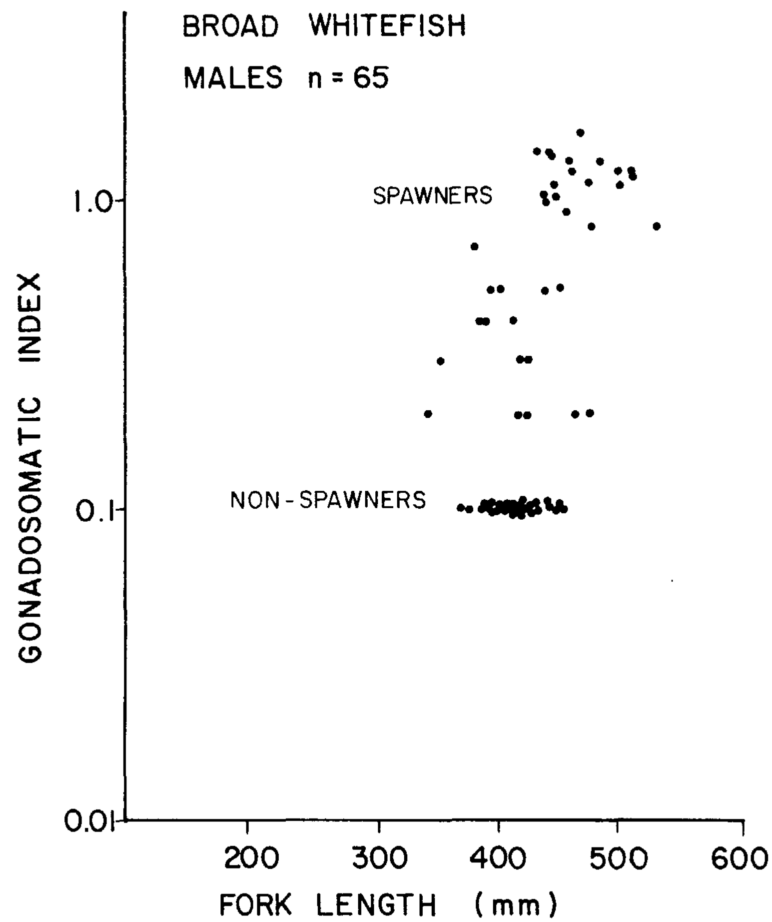

Fig. 8. Gonadosomatic index vs fork length for male broad whitefish captured in Tuktoyaktuk Harbour, 1980.

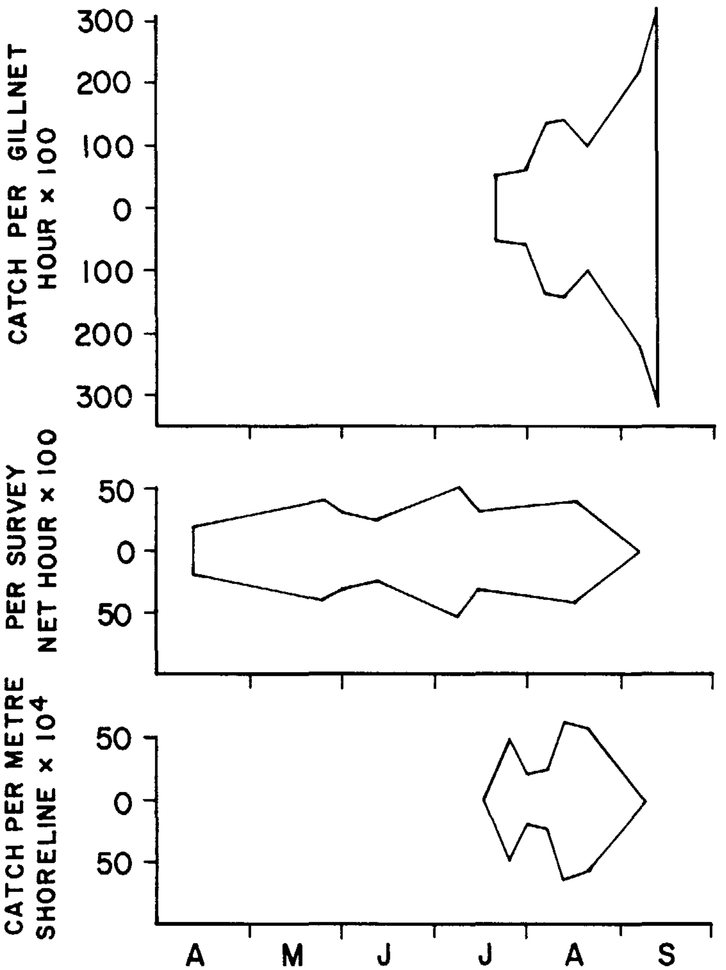

Fig. 9. Seasonal changes in catch-per-unit-effort for lake whitefish captured in gillnets, survey nets, and seines in Tuktoyaktuk Harbour, 1980.

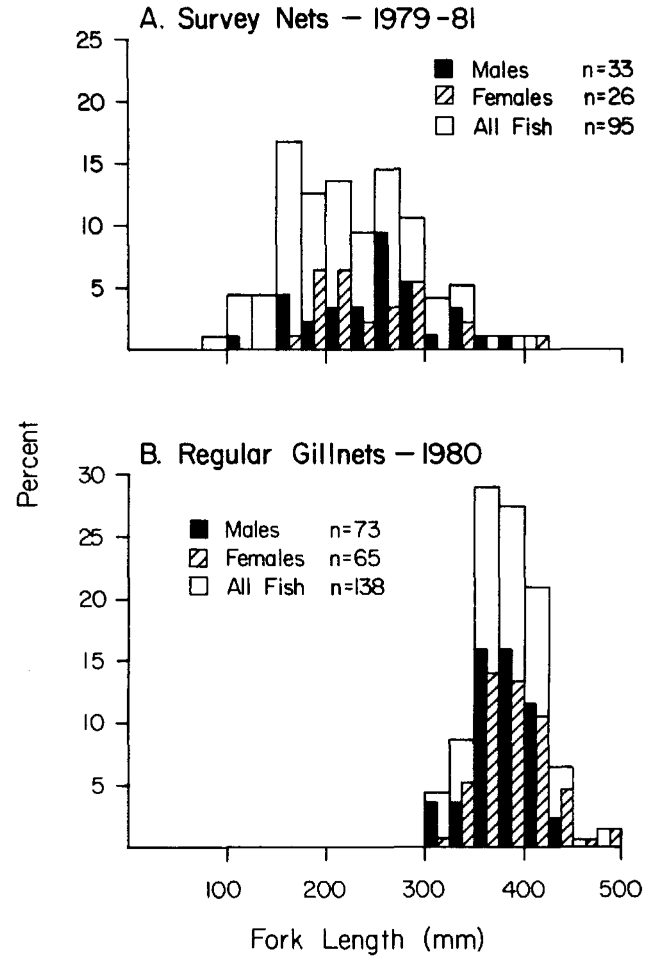

Fig. 10. Length-frequency distribution for lake whitefish captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981.

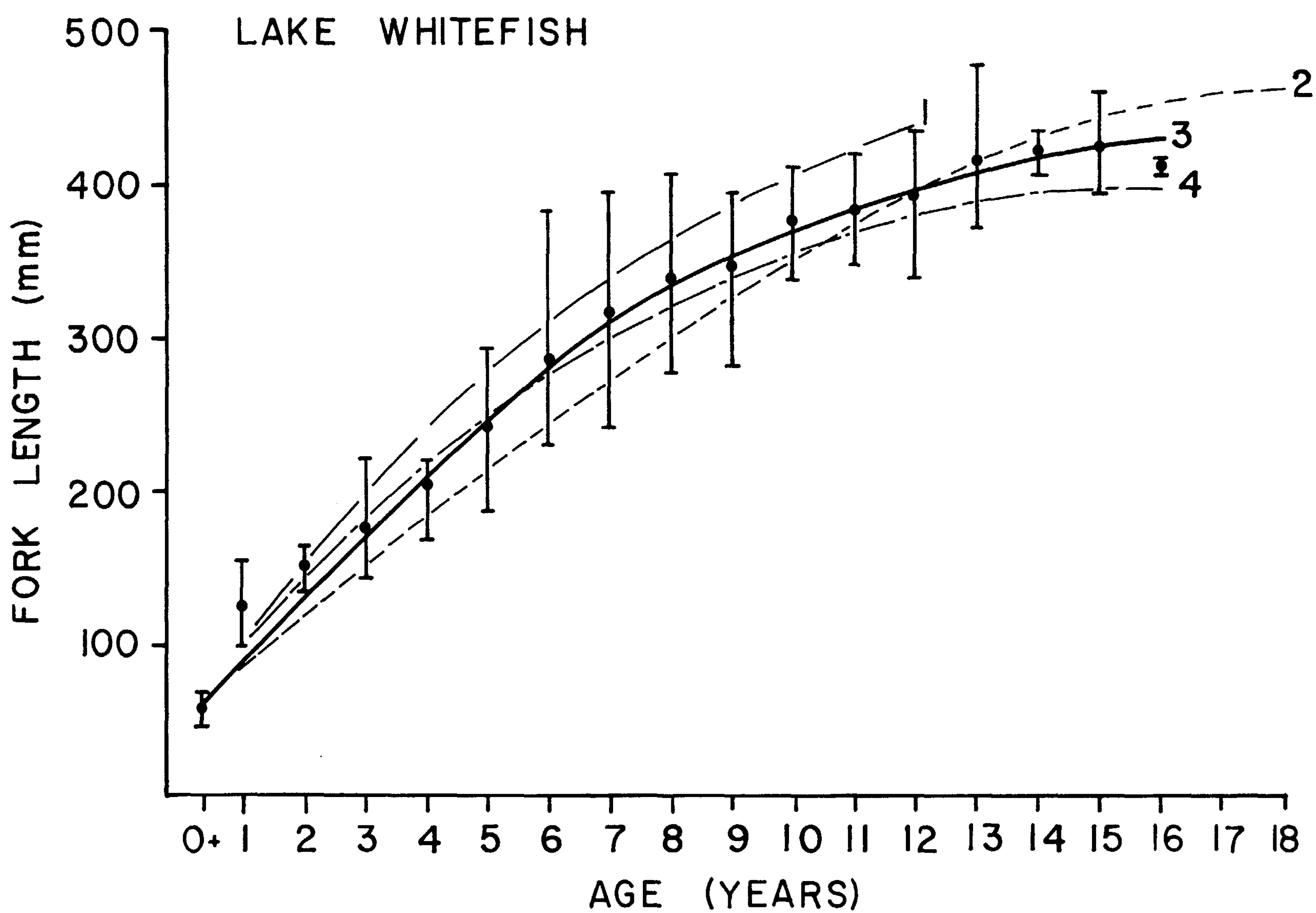

Fig. 11. Comparison of growth rate for lake whitefish from Tuktoyaktuk Harbour with those from several other areas: 1. Alaska (Alt 1979); 2. Mackenzie R. (de Graaf and Machniak 1977); 3. Tuktoyaktuk Harbour (Present Study); 4. Kukjuktuk Cr. (Fallis et al. in prep.).

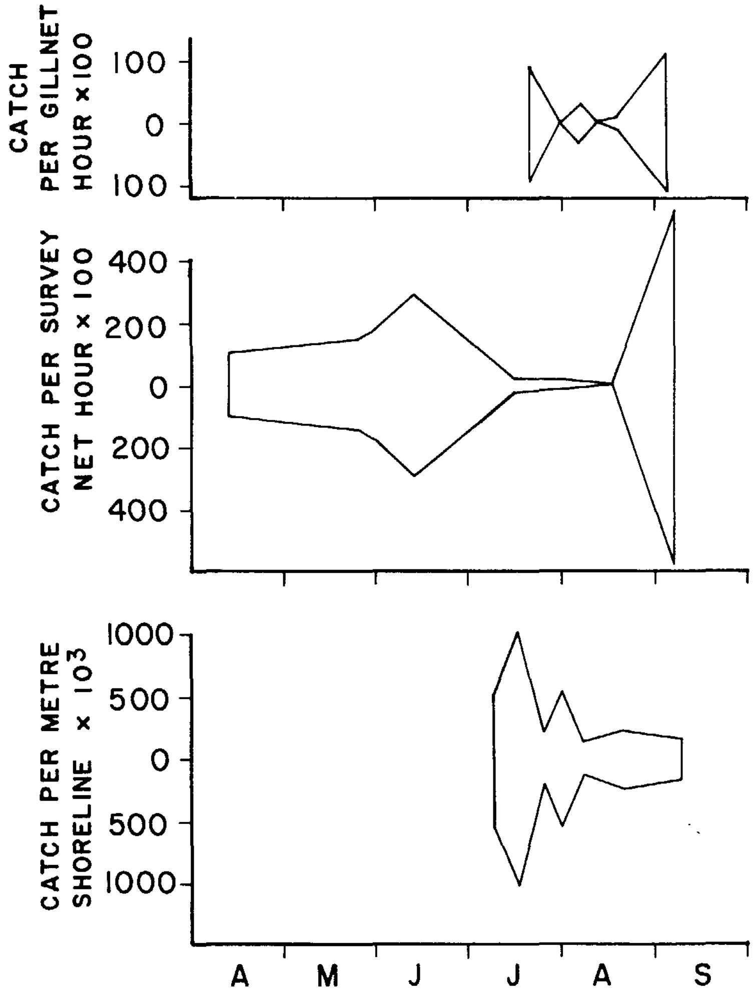

Fig. 12. Seasonal changes in catch-per-unit-effort for Arctic cisco captured in gillnets, survey nets, and seines in Tuktoyaktuk Harbour, 1980.

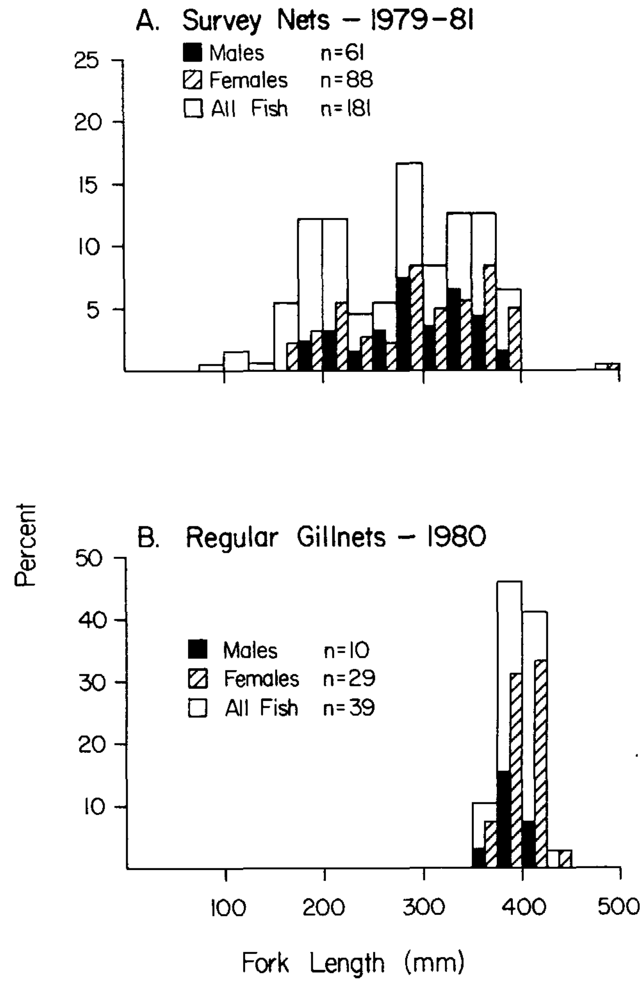

Fig. 13. Length-frequency distribution for Arctic cisco captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981. (Seine catches excluded).

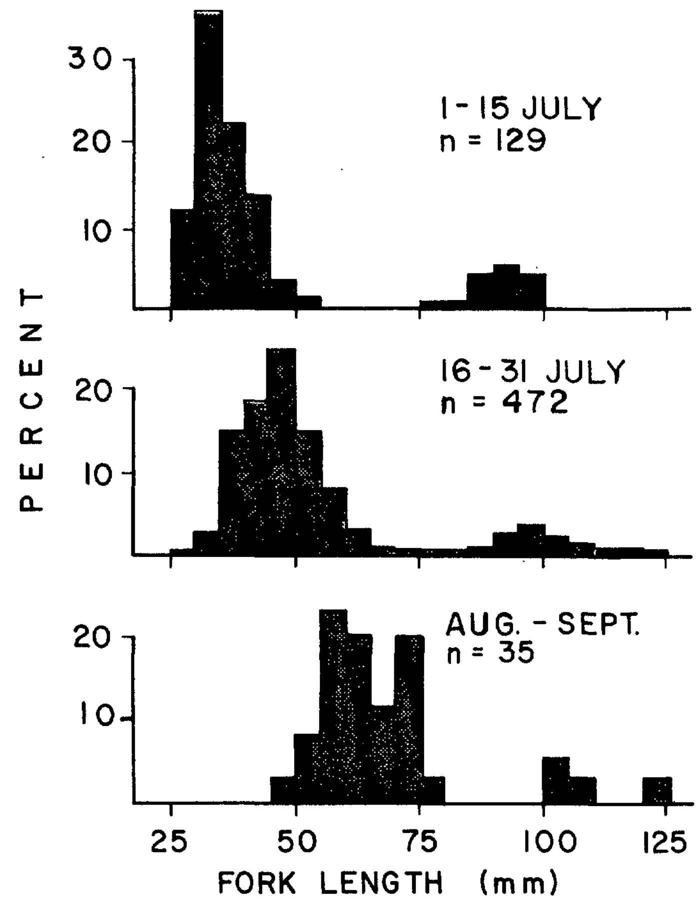

Fig. 14. Change in length-frequency distribution over time for Arctic cisco captured in seines in Tuktoyaktuk Harbour during summer, 1980.

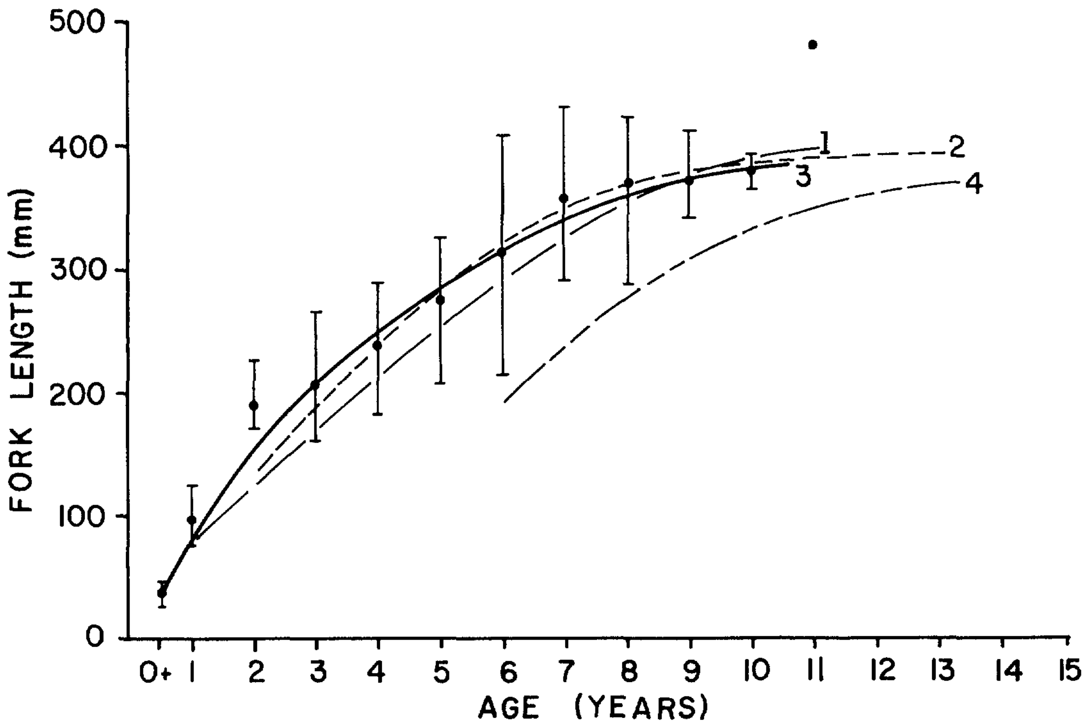

Fig. 15. Comparison of growth rate for Arctic cisco from Tuktoyaktuk Harbour with those from several other areas: 1. Tuk Peninsula (Jones and den Beste 1977); 2. Yukon Coast (Craig and Mann 1974); 3. Tuk Harbour (Present Study); 4. Tuk Peninsula (Galbraith and Hunter 1975).

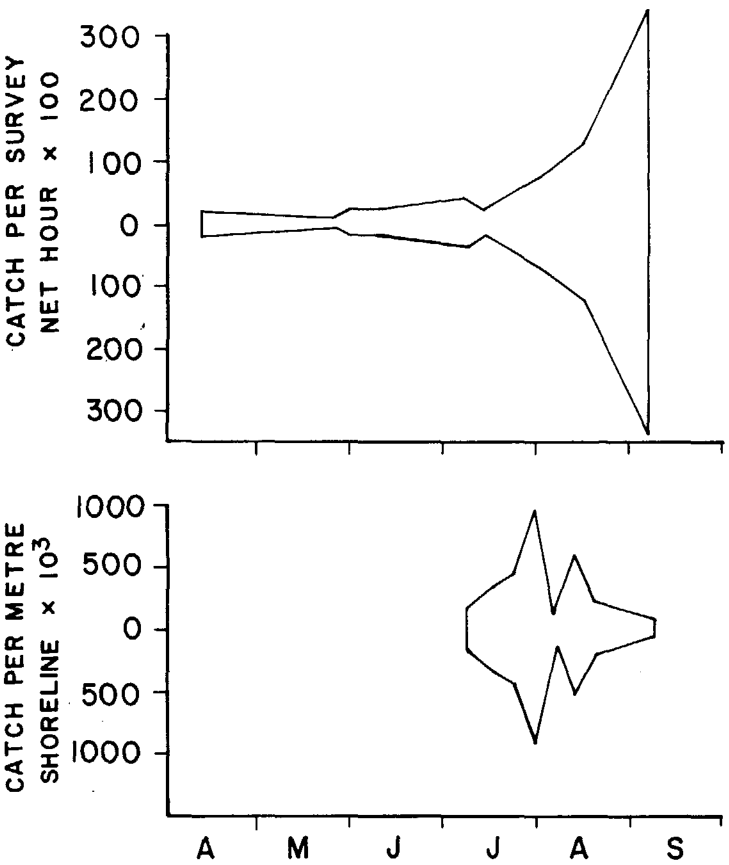

Fig. 16. Seasonal changes in catch-per-unit-effort for least cisco captured in survey nets and seines in Tuktoyaktuk Harbour, 1980.

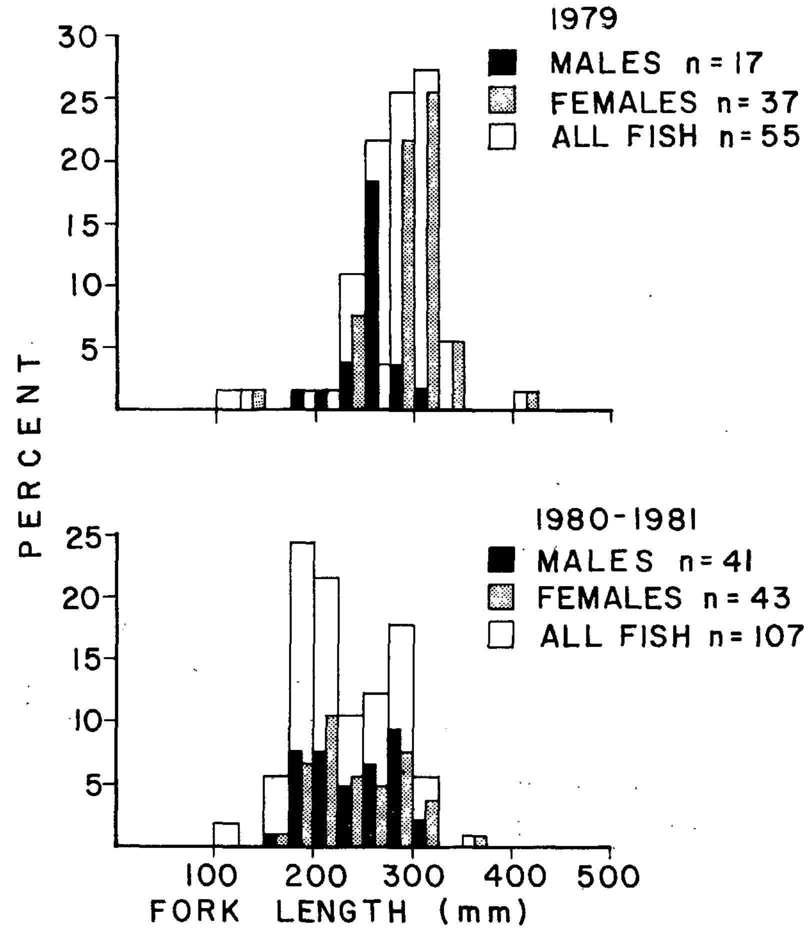

Fig. 17. Length-frequency distribution for least cisco captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981 (Seine catches excluded).

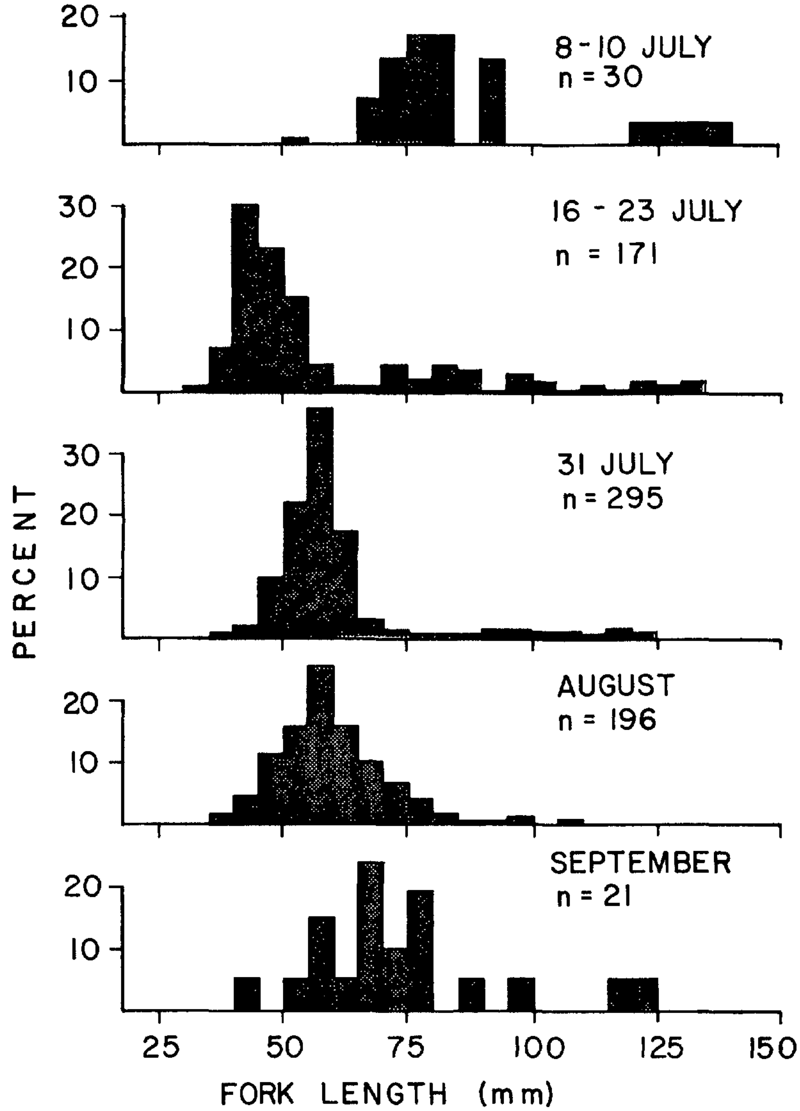

Fig. 18. Change in length-frequency distribution over time for least cisco captured in seines in Tuktoyaktuk Harbour during summer, 1980.

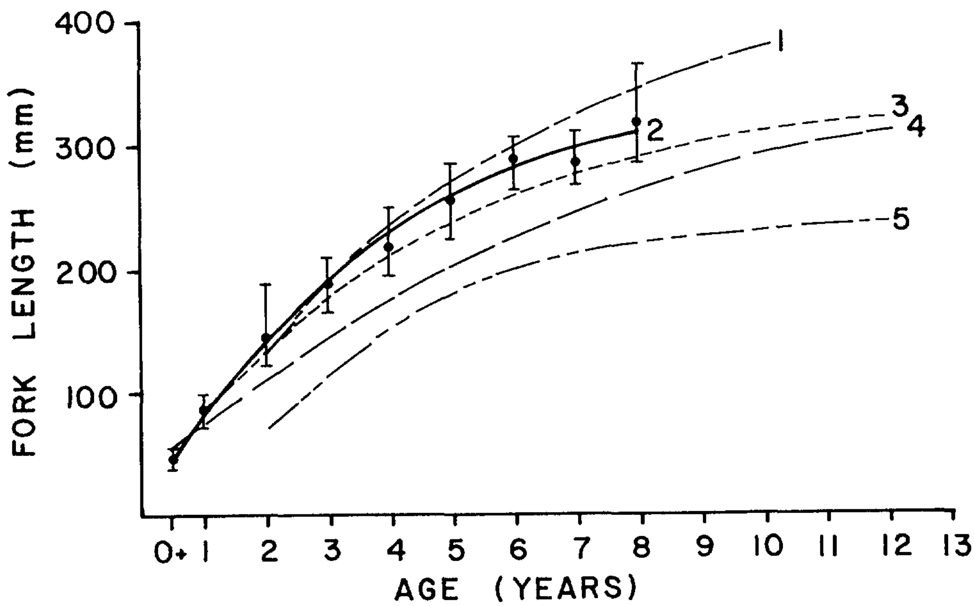

Fig. 19. Comparison of growth rate for least cisco from Tuktoyaktuk Harbour with those from several other areas: 1. Kukjuktuk Cr. (Fallis et al. in prep.); 2. Tuk Harbour (Present Study); 3. Yukon Coast (Mann 1974); 4. Mackenzie R. (de Graaf and Machniak 1977); 5. Tuk Peninsula (Galbraith and Hunter 1975)

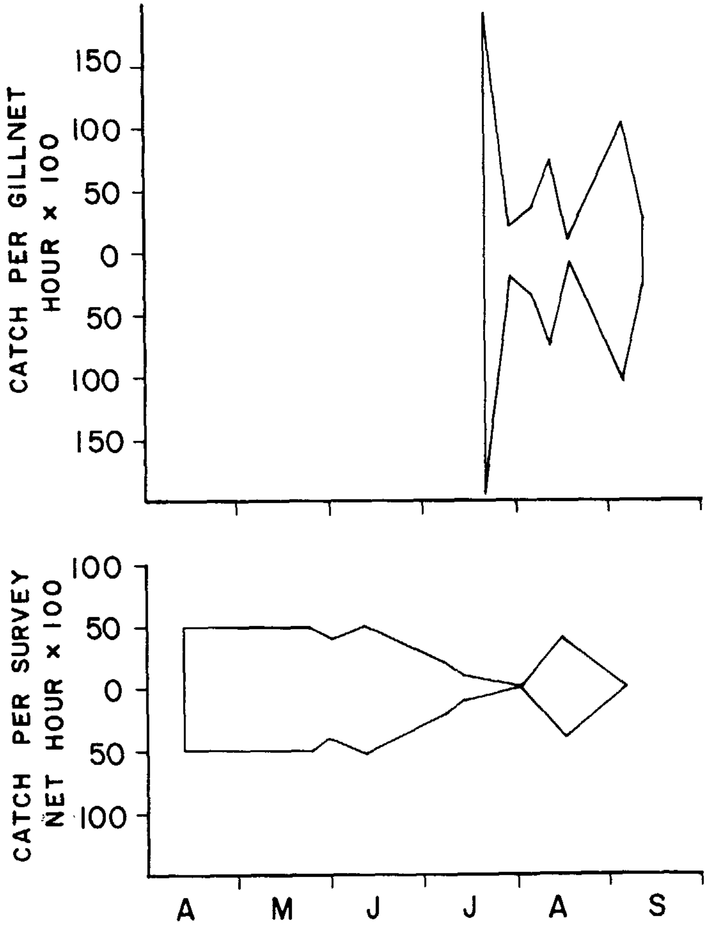

Fig. 20. Seasonal changes in catch-per-unit-effort for inconnu captured in gillnets and survey nets in Tuktoyaktuk Harbour, 1980.

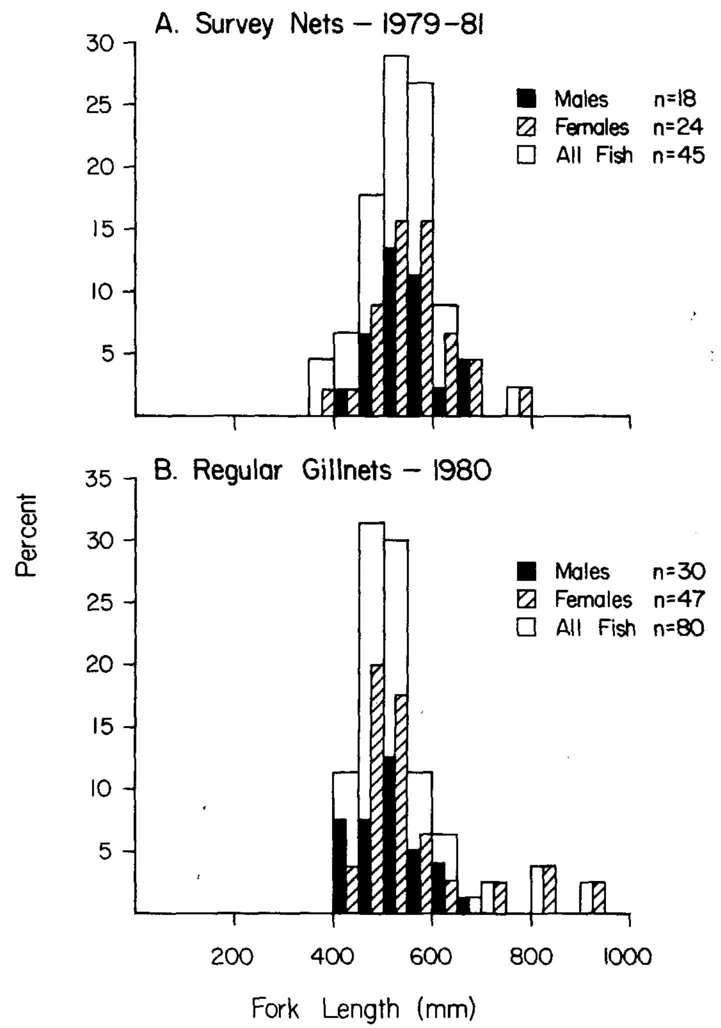

Fig. 21. Length-frequency distribution for inconnu captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981.

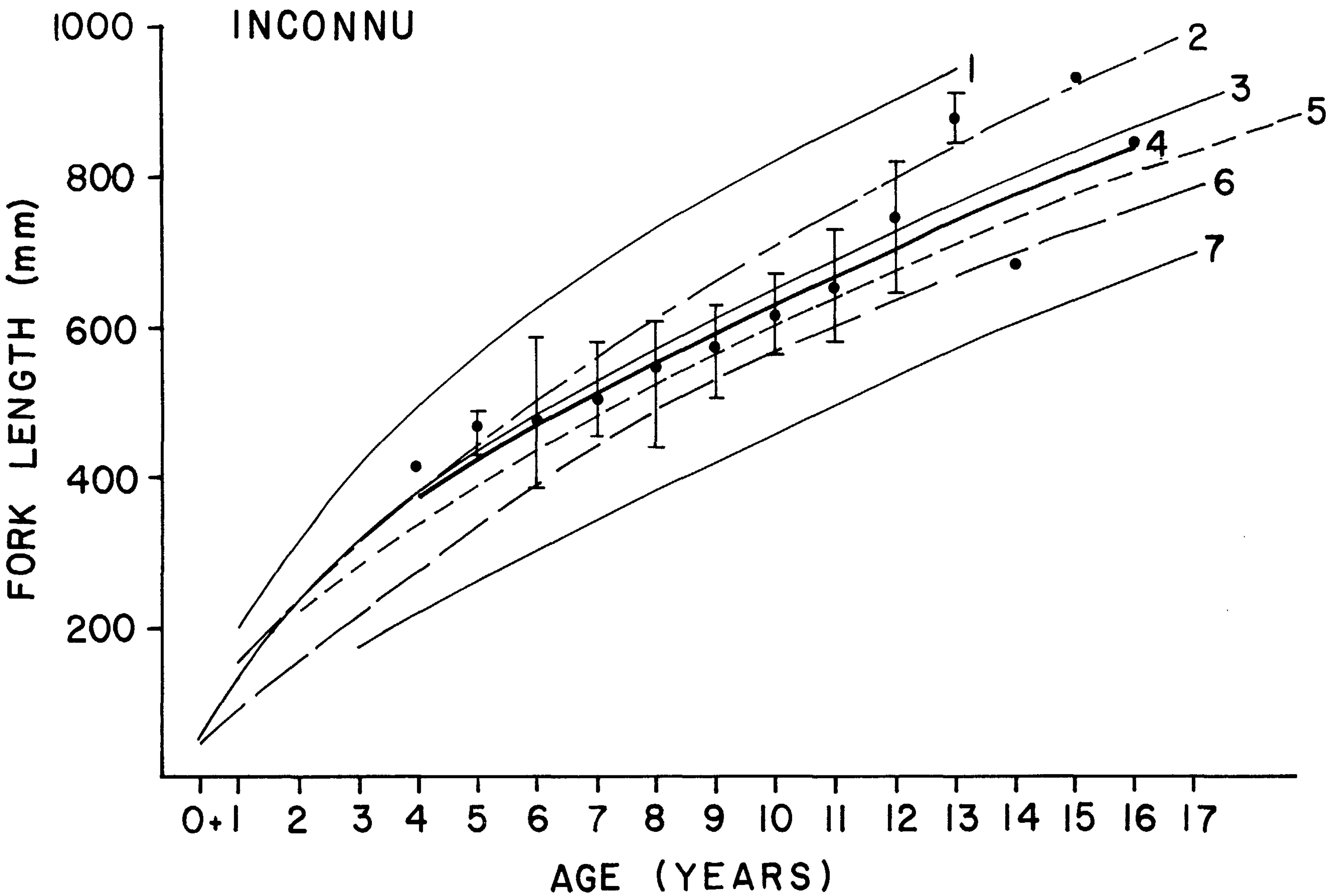

Fig. 22. Comparison of growth rate for inconnu from Tuktoyaktuk Harbour with those from several other areas: 1. Kuskokwim R., Alaska (Alt 1973); 2. Kobuk R.-Selawik R., Alaska (Alt 1973); 3. Mackenzie R. (Stein et al. 1973); 4. Tuk Harbour (Present Study); 5. Mackenzie R. (Percy 1975); 6. Mackenzie R. (de Graaf and Machniak 1977); 7. Tuk Peninsula (Galbraith and Hunter 1975).

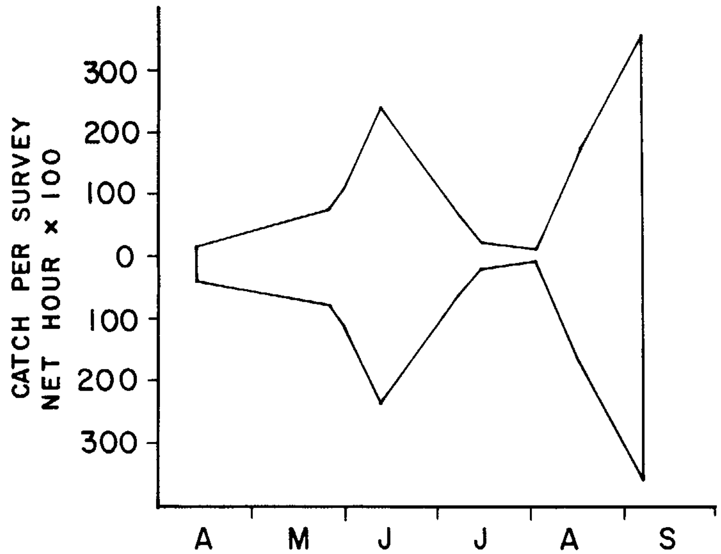

Fig. 23. Seasonal changes in catch-per-unit-effort for Pacific herring captured in survey nets in Tuktoyaktuk Harbour, 1980.

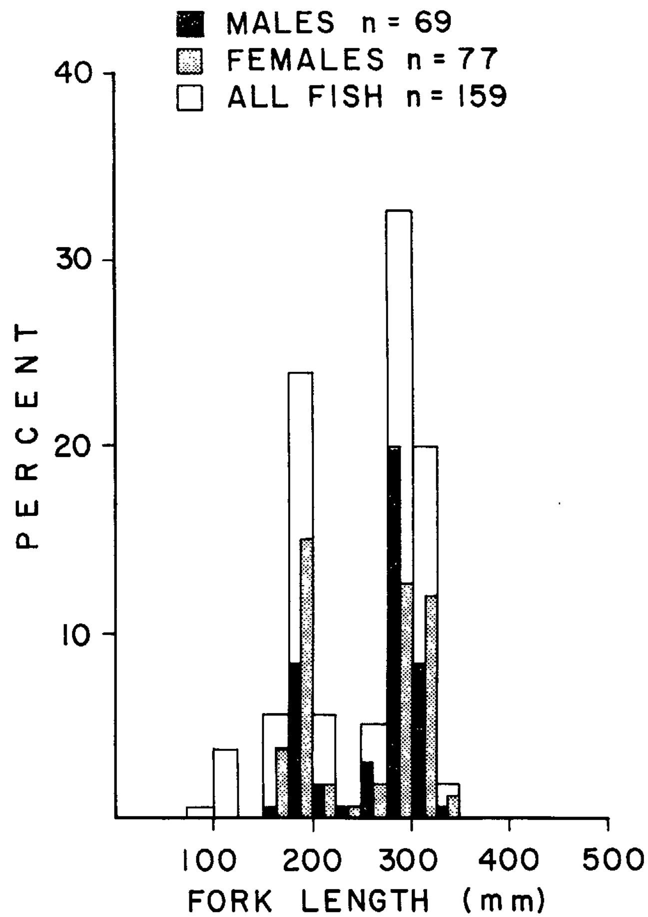

Fig. 24. Length-frequency distribution for Pacific herring captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981.

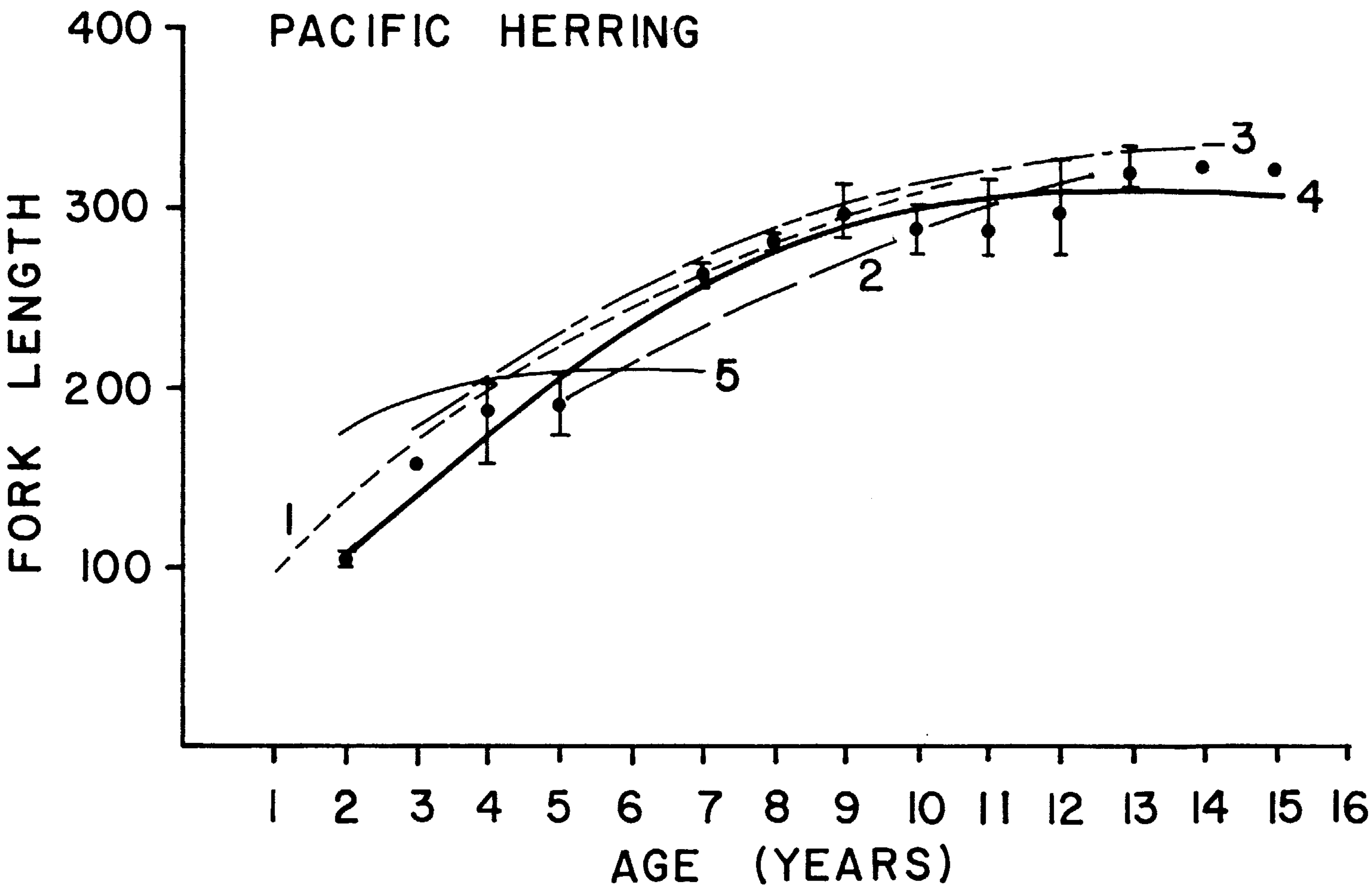

Fig. 25. Comparison of growth rate for Pacific herring from Tuktoyaktuk Harbour with those from several other areas: 1. Kukjuktuk Bay (Fallis et al. in prep.); 2. Tuk Peninsula (Galbraith and Hunter 1975); 3. Tuk Harbour (Riske 1960); 4. Tuk Harbour (Present Study); 5. Walker Rock, B.C. (Riske 1960).

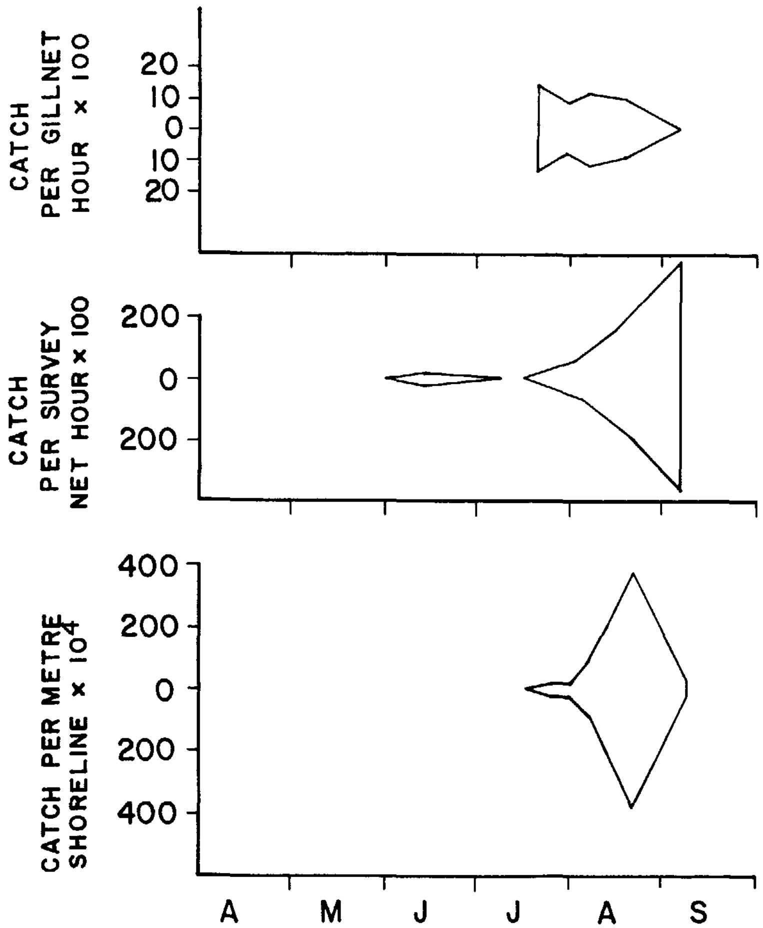

Fig. 26. Seasonal changes in catch-per-unit-effort for rainbow smelt captured in gillnets, survey nets, and seines in Tuktoyaktuk Harbour, 1980.

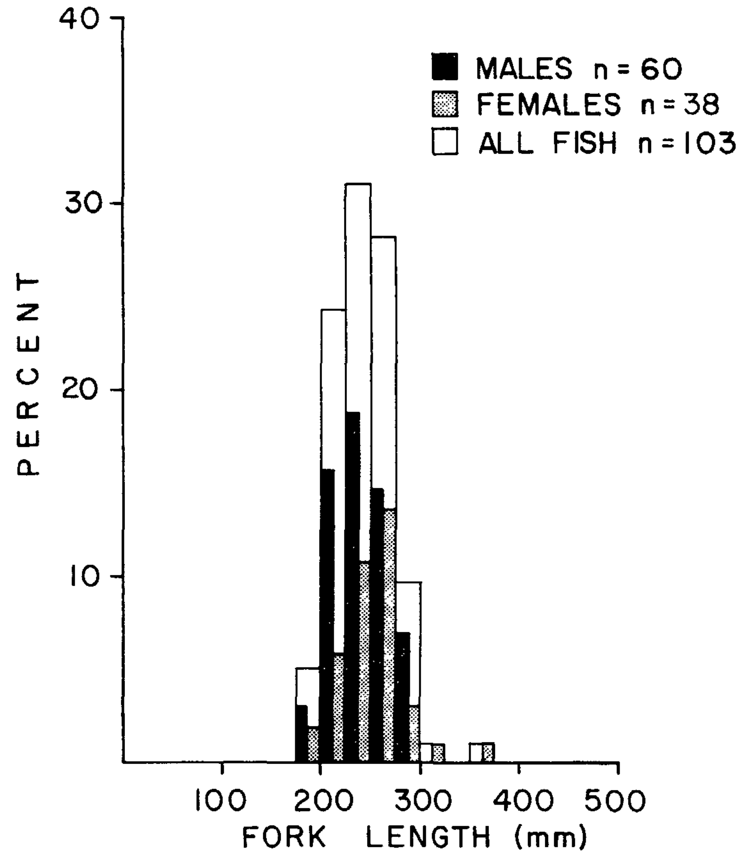

Fig. 27. Length-frequency distribution for rainbow smelt captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981 (Seine catches excluded).

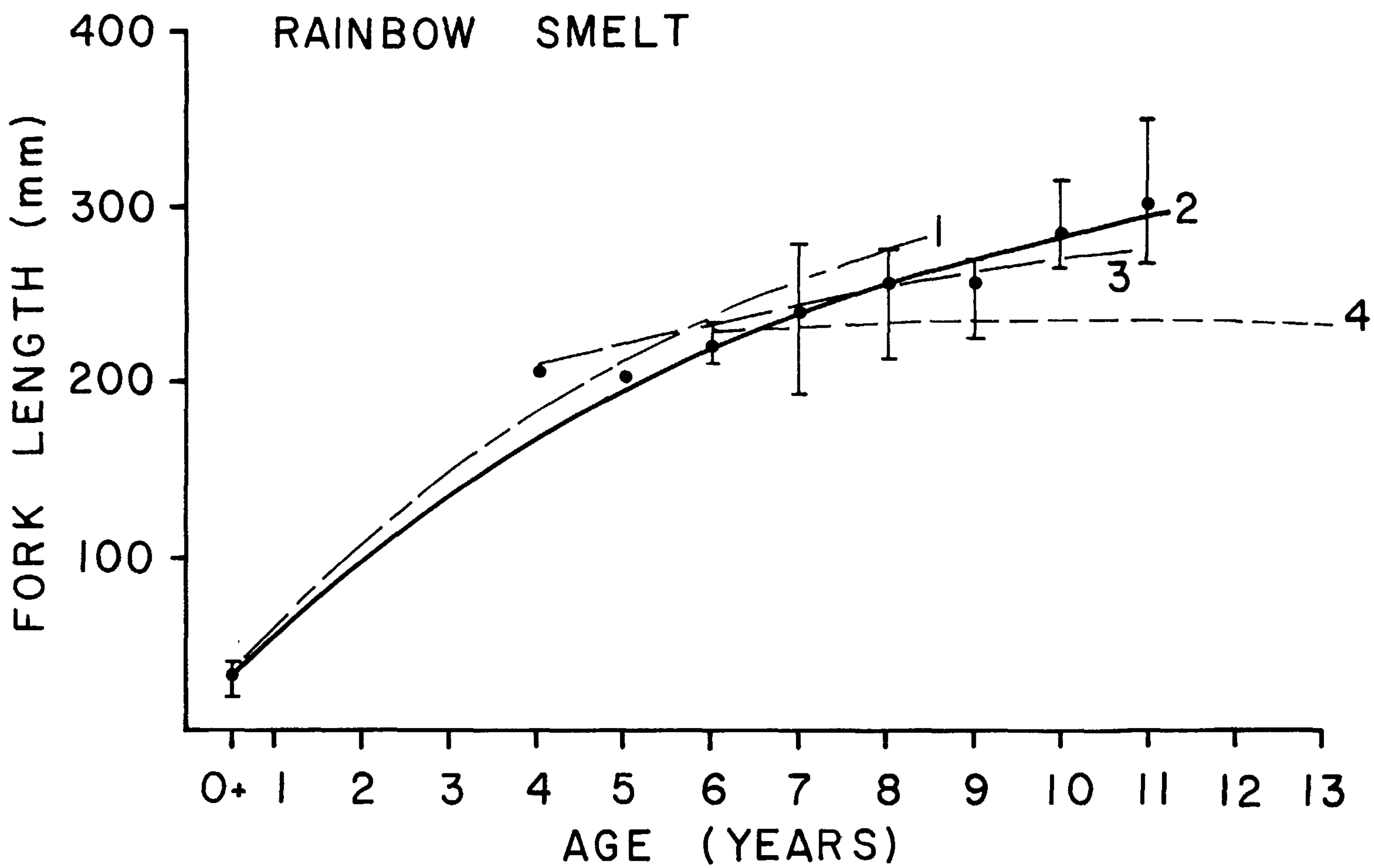

Fig. 28. Comparison of growth rate for rainbow smelt from Tuktoyaktuk Harbour with those from several other areas: 1. Mackenzie R. (Percy 1975); 2. Tuk Harbour (Present Study); 3. Kukjuktuk Bay (Fallis et al. in pren.); 4. Tuk Peninsula (Galbraith and Hunter 1975).

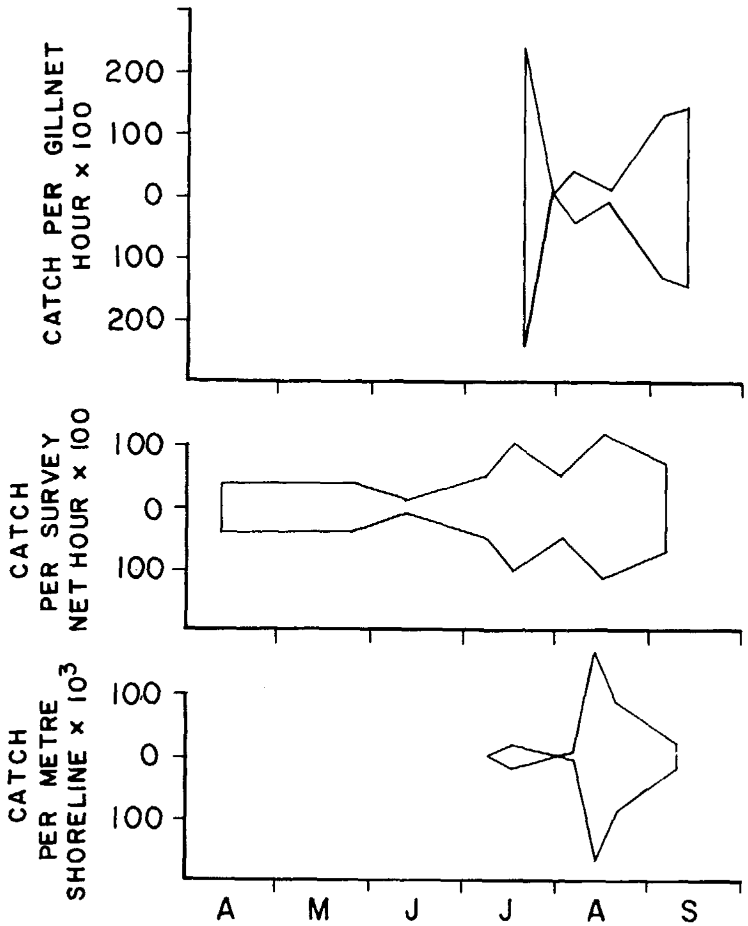

Fig. 29. Seasonal changes in catch-per-unit-effort for fourhorn sculpin captured in gillnets, survey nets, and seines in Tuktoyaktuk Harbour, 1980.

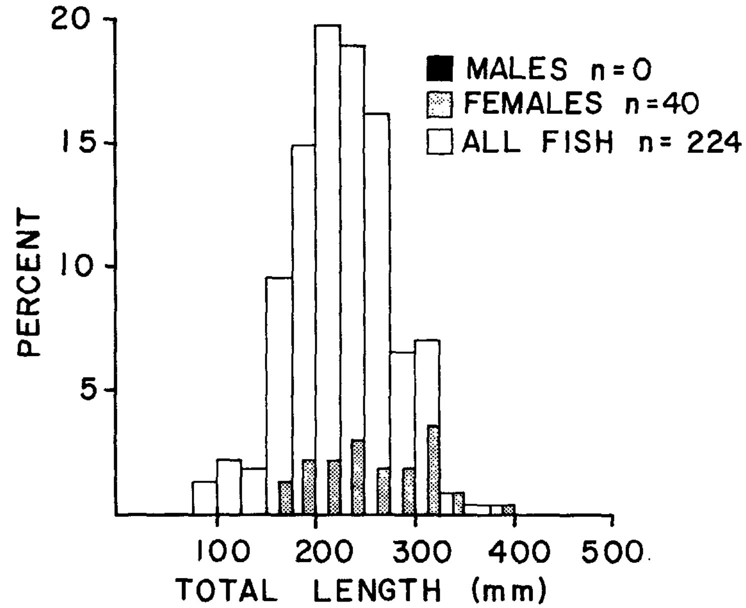

Fig. 30. Length-frequency distribution for fourhorn sculpin captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981 (Seine catches excluded).

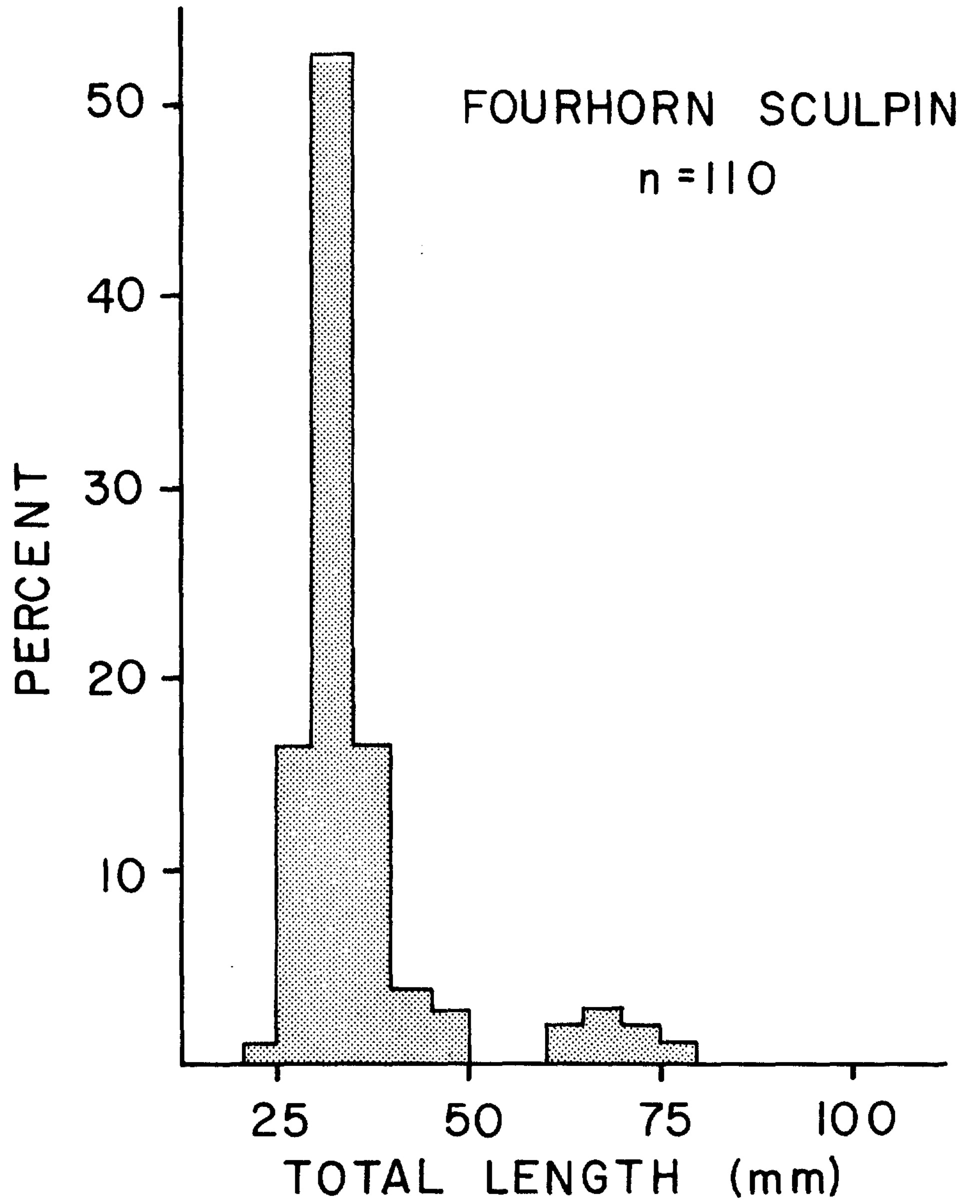

Fig. 31. Length-frequency distribution for fourhorn sculpin captured by seines in Tuktoyaktuk Harbour, 1980

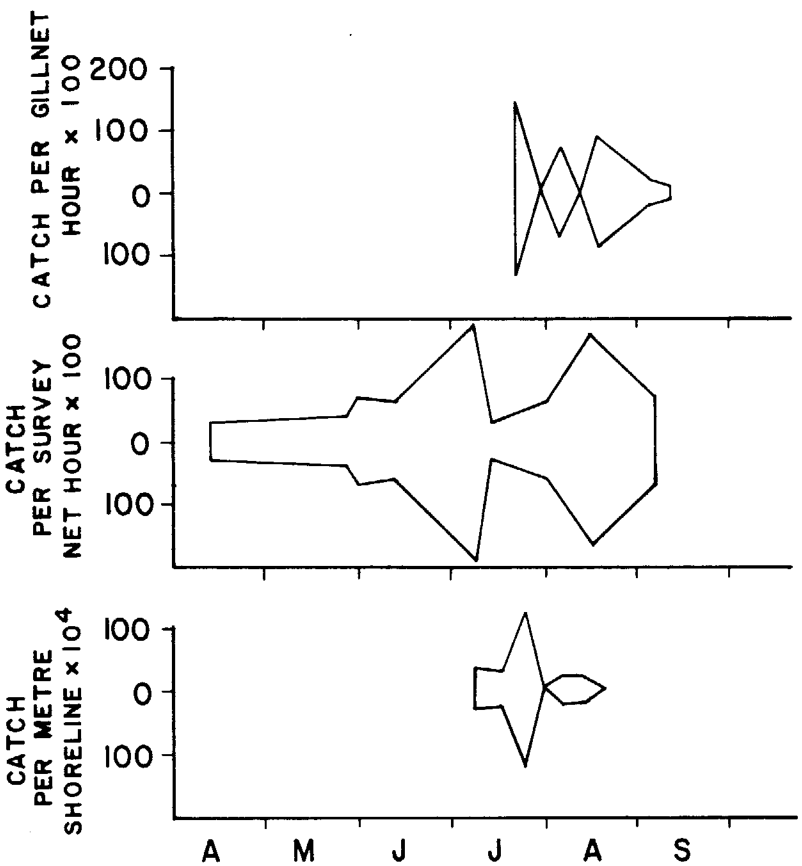

Fig. 32. Seasonal changes in catch-per-unit-effort for starry flounder captured in gillnets, survey nets, and seines in Tuktoyaktuk Harbour, 1980.

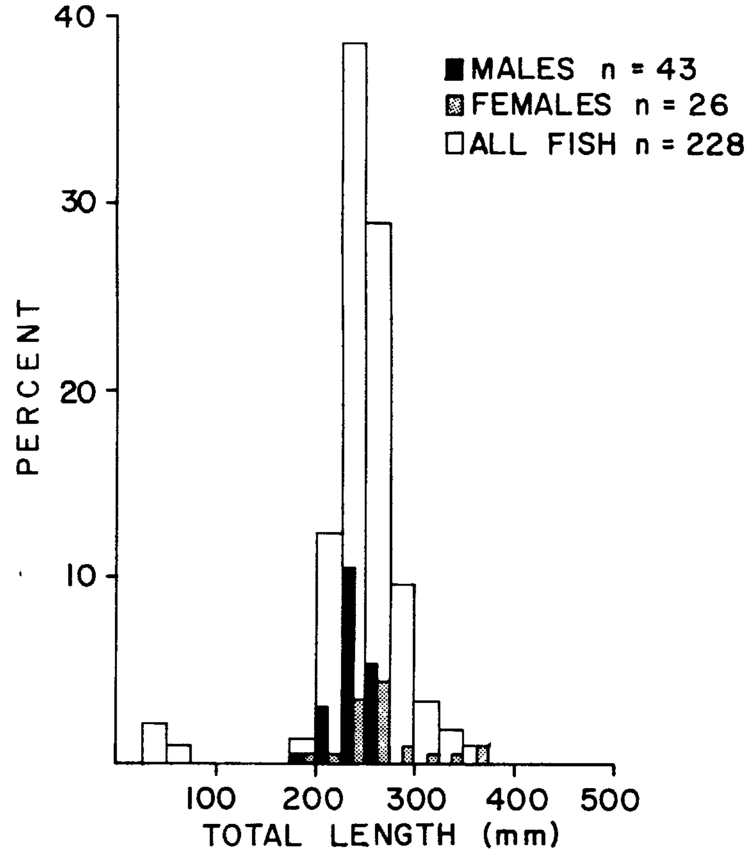

Fig. 33. Length-frequency distribution for starry flounder captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981.

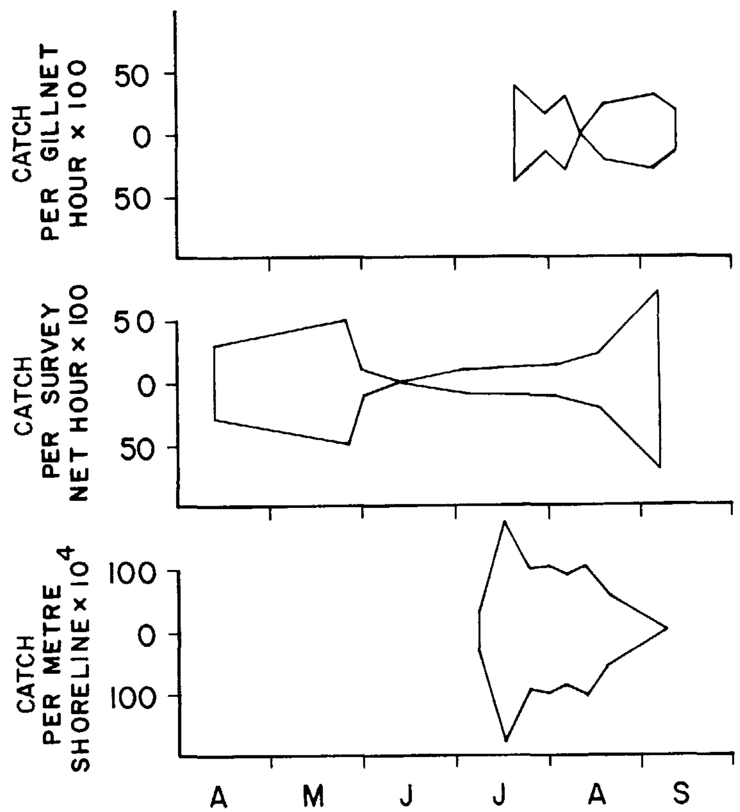

Fig. 34. Seasonal changes in catch-per-unit-effort for Arctic flounder captured in gillnets, survey nets, and seines in Tuktoyaktuk Harbour, 1980.

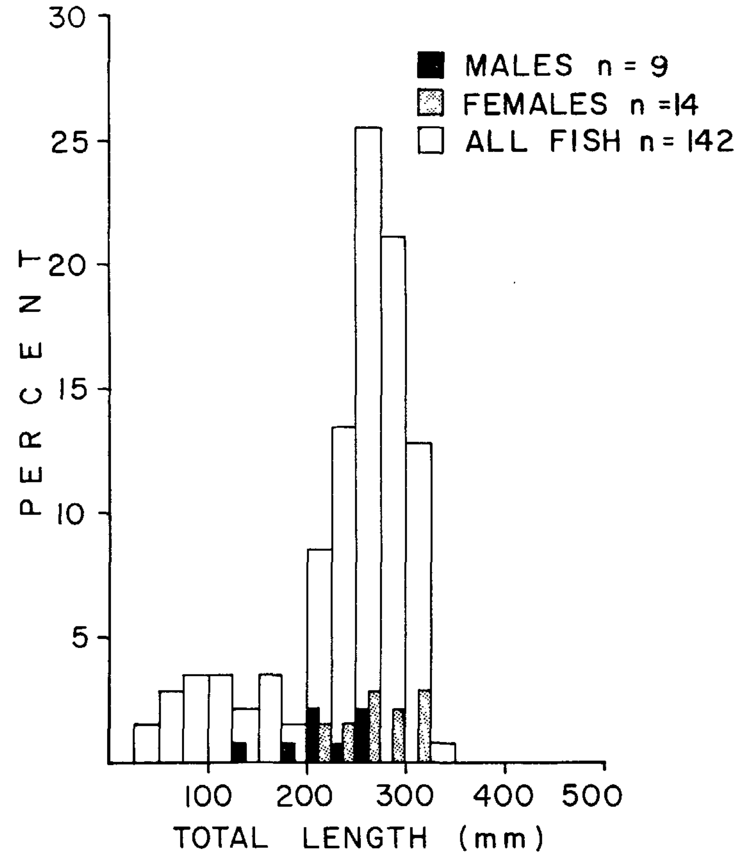

Fig. 35. Length-frequency distribution for Arctic flounder captured in Tuktoyaktuk Harbour between 25 July 1979 and 9 January 1981.

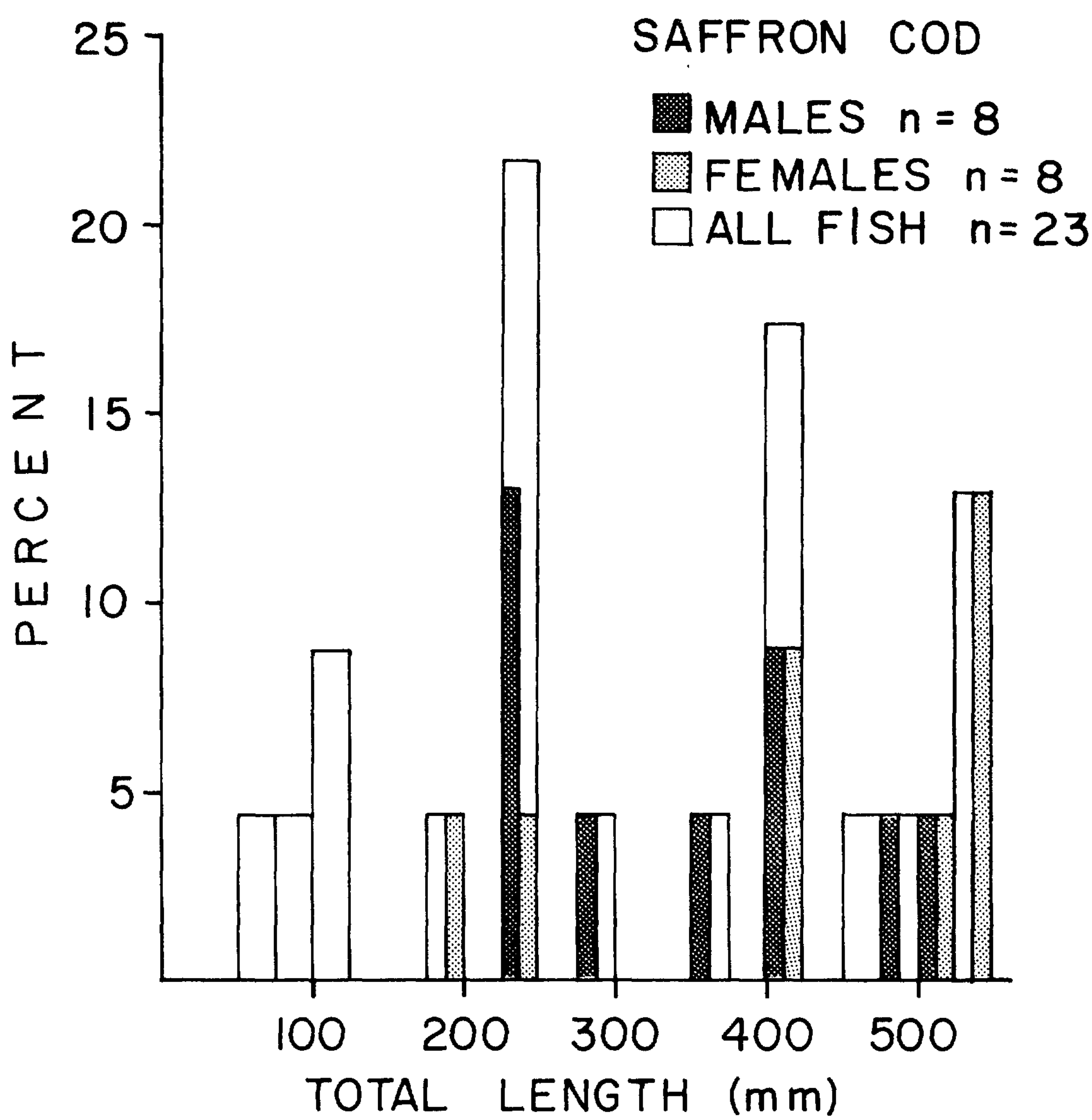

Fig. 36. Length-frequency distribution for saffron cod from Tuktoyaktuk Harbour, 1980.

APPENDIX 1

Table 1.1. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 13-15 April 1980.

Site		Species Captured													Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT		
3	N	-	1	1	1	1	-	-	-	2	2	3	2	-	13	120
	%	-	7.7	7.7	7.7	7.7	-	-	-	15.4	15.4	23.1	15.4	-		
	c/e	-	0.500	0.500	0.500	0.500	-	-	-	1.000	1.000	1.500	1.000	-		
6	N	-	1	2	-	2	1	-	-	-	1	1	-	-	8	120
	%	-	12.5	25.0	-	25.0	12.5	-	-	-	12.5	12.5	-	-		
	c/e	-	0.500	1.000	-	1.000	0.500	-	-	-	0.500	0.500	-	-		
7	N	-	-	5	1	1	-	-	-	-	-	-	-	-	7	120
	%	-	-	71.4	14.3	14.3	-	-	-	-	-	-	-	-		
	c/e	-	-	2.500	0.500	0.500	-	-	-	-	-	-	-	-		
8	N	-	-	2	-	-	-	-	-	-	-	-	-	-	2	120
	%	-	-	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	1.000	-	-	-	-	-	-	-	-	-	-		
9	N	-	-	-	-	1	1	-	-	1	-	-	-	-	3	120
	%	-	-	-	-	33.3	33.3	-	-	33.3	-	-	-	-		
	c/e	-	-	-	-	0.500	0.500	-	-	0.500	-	-	-	-		
4	N	-	-	1	-	1	-	-	-	-	-	-	-	-	2	120
	%	-	-	50.0	-	50.0	-	-	-	-	-	-	-	-		
	c/e	-	-	0.500	-	0.500	-	-	-	-	-	-	-	-		
5	N	-	1	1	-	-	-	-	-	-	-	-	-	-	2	125
	%	-	50.0	50.0	-	-	-	-	-	-	-	-	-	-		
	c/e	-	0.480	0.480	-	-	-	-	-	-	-	-	-	-		
10	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120
	%	-	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-	-		
11		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	N	-	3	12	2	6	2	-	-	3	3	4	2	-	37	965
	%	-	8.1	32.4	5.4	16.2	5.4	-	-	8.1	8.1	10.8	5.4	-		
	c/e	-	0.187	0.746	0.124	0.373	0.124	-	-	0.187	0.187	0.249	0.124	-		

See page 31 for explanation of species codes.

Table 1.2. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 25-28 May 1980.

Site		Species Captured													Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT		
3	N	-	1	2	-	-	1	-	1	3	2	-	-	-	10	120
	%	-	10.0	20.0	-	-	10.0	-	10.0	30.0	20.0	-	-	-		
	c/e	-	0.500	1.000	-	-	0.500	-	0.500	1.500	1.000	-	-	-		
6	N	-	-	-	-	2	-	-	-	-	-	-	-	-	2	120
	%	-	-	-	-	100.0	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	1.000	-	-	-	-	-	-	-	-		
7	N	-	-	13	1	3	-	-	-	-	-	-	-	-	17	120
	%	-	-	76.5	5.9	17.6	-	-	-	-	-	-	-	-		
	c/e	-	-	6.500	0.500	1.500	-	-	-	-	-	-	-	-		
8	N	-	3	-	-	-	-	-	-	-	3	-	-	-	6	120
	%	-	50.0	-	-	-	-	-	-	-	50.0	-	-	-		
	c/e	-	2.500	-	-	-	-	-	-	-	2.500	-	-	-		
9	N	-	-	-	-	-	7	-	-	1	-	4	-	-	12	130
	%	-	-	-	-	-	58.3	-	-	8.3	-	33.3	-	-		
	c/e	-	-	-	-	-	3.231	-	-	0.462	-	1.846	-	-		
4	N	-	1	3	-	-	-	-	-	-	-	-	-	-	4	135
	%	-	25.0	75.0	-	-	-	-	-	-	-	-	-	-		
	c/e	-	0.444	1.333	-	-	-	-	-	-	-	-	-	-		
5	N	-	1	4	-	1	-	-	-	-	-	-	-	-	6	150
	%	-	16.7	66.7	-	16.7	-	-	-	-	-	-	-	-		
	c/e	-	0.400	1.600	-	0.400	-	-	-	-	-	-	-	-		
10	N	-	-	2	-	-	-	-	-	-	-	-	-	-	2	135
	%	-	-	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	0.889	-	-	-	-	-	-	-	-	-	-		
11	N	-	-	1	4	1	4	-	-	-	-	-	1	-	11	120
	%	-	-	9.1	36.4	9.1	36.4	-	-	-	-	-	9.1	-		
	c/e	-	-	0.500	2.000	0.500	2.000	-	-	-	-	-	0.500	-		
Total	N	-	6	25	5	7	12	-	1	4	5	4	1	=	70	1150
	%	-	8.6	35.7	7.1	10.0	17.1	-	1.4	5.7	7.1	5.7	1.4	-		
	c/e	-	0.313	1.304	0.261	0.365	0.626	-	0.052	0.209	0.261	0.209	0.052	-		

Table 1.3. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 31 May - 2 June 1980.

Site		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT	Total	Minutes Set
		Species Captured														
3	N	-	3	2	1	1	3	-	-	4	1	1	-	-	16	120
	%	-	18.8	12.5	6.3	6.3	18.8	-	-	25.0	6.3	6.3	-	-		
	c/e	-	1.500	1.000	0.500	0.500	1.500	-	-	2.000	0.500	0.500	-	-		
6	N	-	-	6	-	1	-	-	-	1	-	-	-	-	8	120
	%	-	-	75.0	-	12.5	-	-	-	12.5	-	-	-	-		
	c/e	-	-	3.000	-	0.500	-	-	-	0.500	-	-	-	-		
7	N	-	-	7	-	1	2	-	-	-	-	-	-	-	10	120
	%	-	-	70.0	-	10.0	20.0	-	-	-	-	-	-	-		
	c/e	-	-	3.500	-	0.500	1.000	-	-	-	-	-	-	-		
8	N	-	-	1	1	-	-	-	1	2	-	-	-	-	5	120
	%	-	-	20.0	20.0	-	-	-	20.0	40.0	-	-	-	-		
	c/e	-	-	0.500	0.500	-	-	-	0.500	1.000	-	-	-	-		
9	N	-	-	2	-	1	6	-	-	-	-	2	-	-	11	120
	%	-	-	18.2	-	9.1	54.5	-	-	-	-	18.2	-	-		
	c/e	-	-	1.000	-	0.500	3.000	-	-	-	-	1.000	-	-		
4	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120
	%	-	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-	-		
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120
	%	-	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-	-		
11		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	N	-	3	18	2	4	11	-	1	7	1	3	-	-	50	840
	%	-	6.0	36.0	4.0	8.0	22.0	-	2.0	14.0	2.0	6.0	-	-		
	c/e	-	0.214	1.286	0.143	0.286	0.786	-	0.071	0.500	0.071	0.214	-	-		

Table 1.4. Number (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 12-13 June 1980.

Site		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT	Total	Minutes Set
		Species Captured														
3	N	2	1	1	1	2	7	-	1	2	-	1	-	-	18	120
	%	11.1	5.6	5.6	5.6	11.1	38.9	-	5.6	11.1	-	5.6	-	-		
	c/e	1.000	0.500	0.500	0.500	1.000	3.500	-	0.500	1.000	-	0.500				
6	N	-	-	6	-	1	8	-	-	-	-	-	1	-	16	120
	%	-	-	37.5	-	6.3	50.0	-	-	-	-	-	6.3	-		
	c/e	-	-	3.000	-	0.500	4.000	-	-	-	-	-	0.500	-		
7	N	-	-	15	-	1	4	1	-	-	-	-	-	-	21	120
	%	-	-	71.4	-	4.8	19.0	4.8	-	-	-	-	-	-		
	c/e	-	-	7.500	-	0.500	2.000	0.500	-	-	-	-	-	-		
8	N	-	1	1	1	-	-	-	-	3	-	-	-	-	6	120
	%	-	16.7	16.7	16.7	-	-	-	-	50.0	-	-	-	-		
	c/e	-	0.500	0.500	0.500	-	-	-	-	1.500	-	-	-	-		
9		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	N	2	2	23	2	4	19	1	1	5	-	1	1	-	61	480
	%	3.3	3.3	37.7	3.3	6.6	31.1	1.6	1.6	8.2	-	1.6	1.6	-		
	c/e	0.250	0.250	2.875	0.250	0.500	2.375	0.125	0.125	0.625	-	0.125	0.125	-		

Table 1.5. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 7-9 July 1980.

Site		Species Captured													Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT		
3	N	-	-	1	1	1	4	-	1	-	1	3	-	-	12	120
	%	-	-	8.3	8.3	8.3	33.3	-	8.3	-	8.3	25.0	-	-		
	c/e	-	-	0.500	0.500	0.500	2.000	-	0.500	-	0.500	1.500	-	-		
6	N	-	1	-	-	-	-	-	-	1	-	1	-	-	3	120
	%	-	33.3	-	-	-	-	-	-	33.3	-	33.3	-	-		
	c/e	-	0.500	-	-	-	-	-	-	0.500	-	0.500	-	-		
7	N	-	-	-	-	-	-	-	-	3	-	-	-	-	3	120
	%	-	-	-	-	-	-	-	-	100.0	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	1.500	-	-	-	-		
8	N	1	4	6	3	1	2	-	-	6	-	-	-	-	23	120
	%	4.3	17.4	26.1	13.0	4.3	8.7	-	-	26.1	-	-	-	-		
	c/e	0.500	2.000	3.000	1.500	0.500	1.000	-	-	3.000	-	-	-	-		
9	N	-	-	1	-	-	-	-	-	10	-	1	-	-	12	120
	%	-	-	8.3	-	-	-	-	-	83.3	-	8.3	-	-		
	c/e	-	-	0.500	-	-	-	-	-	5.000	-	0.500	-	-		
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5	N	-	-	1	5	-	1	14	1	2	-	192	1	-	217	330
	%	-	-	0.5	2.3	-	0.5	6.5	0.5	0.9	-	88.5	0.5	-		
	c/e	-	-	0.182	0.909	-	0.182	2.545	0.182	0.364	-	34.909	0.182	-		
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11	N	-	-	1	-	-	-	-	-	1	-	56	-	-	58	285
	%	-	-	1.7	-	-	-	-	-	1.7	-	96.6	-	-		
	c/e	-	-	0.211	-	-	-	-	-	0.211	-	11.789	-	-		
Total	N	1	5	10	9	2	7	14	2	23	1	253	1	-	328	1215
	%	0.3	1.5	3.0	2.7	0.6	2.1	4.3	0.6	7.0	0.3	77.1	0.3	-		
	c/e	0.049	0.247	0.494	0.444	0.099	0.346	0.691	0.099	1.136	0.049	12.494	0.049	-		

Table 1.6. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 13-16 July 1980.

Site		Species Captured													Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT		
3	N	-	-	-	-	-	-	-	1	-	-	2	-	-	3	120
	%	-	-	-	-	-	-	-	33.3	-	-	66.7	-	-		
	c/e	-	-	-	-	-	-	-	0.500	-	-	1.000	-	-		
6	N	-	1	-	-	-	-	-	-	-	-	4	-	-	5	120
	%	-	20.0	-	-	-	-	-	-	-	-	80.0	-	-		
	c/e	-	0.500	-	-	-	-	-	-	-	-	2.000	-	-		
7	N	-	-	-	1	-	-	-	-	1	-	4	-	-	6	120
	%	-	-	-	16.7	-	-	-	-	16.7	-	66.7	-	-		
	c/e	-	-	-	0.500	-	-	-	-	0.500	-	2.000	-	-		
8	N	1	2	2	1	1	1	-	-	2	1	-	-	-	11	120
	%	9.1	18.2	18.2	9.1	9.1	9.1	-	-	18.2	9.1	-	-	-		
	c/e	0.500	1.000	1.000	0.500	0.500	0.500	-	-	1.000	0.500	-	-	-		
9	N	-	-	-	-	-	-	-	-	-	-	-	-	1	1	120
	%	-	-	-	-	-	-	-	-	-	-	-	-	100.0		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-	0.500		
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	N	1	3	2	2	1	1	-	1	3	1	10	-	-	26	600
	%	3.8	11.5	7.7	7.7	3.8	3.8	-	3.8	11.5	3.8	38.5	-	-		
	c/e	0.100	0.300	0.200	0.200	0.100	0.100	-	0.100	0.300	0.100	1.000	-	-		

Table 1.7. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 23 July 1980.

Site		Species Captured													Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT		
3		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9	N	-	-	1	-	-	-	2	-	-	-	-	-	-	3	105
	%	-	-	33.3	-	-	-	66.7	-	-	-	-	-	-		
	c/e	-	-	0.571	-	-	-	1.043	-	-	-	-	-	-		
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	N	-	-	1	-	-	-	2	-	-	-	-	-	-	3	105
	%	-	-	33.3	-	-	-	66.7	-	-	-	-	-	-		
	c/e	-	-	0.571	-	-	-	1.043	-	-	-	-	-	-		

Table 1.8. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 2-3 August 1980.

Site		Species Captured													Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT		
3	N	-	-	1	4	-	-	-	2	5	1	3	-	-	16	120
	%	-	-	6.3	25.0	-	-	-	12.5	31.3	6.3	18.8	-	-		
	c/e	-	-	0.500	2.000	-	-	-	1.000	2.500	0.500	1.500	-	-		
6	N	-	-	-	2	-	1	-	-	-	-	-	-	-	3	120
	%	-	-	-	66.7	-	33.3	-	-	-	-	-	-	-		
	c/e	-	-	-	1.000	-	0.500	-	-	-	-	-	-	-		
7	N	-	-	-	-	-	-	3	-	-	-	1	-	-	4	120
	%	-	-	-	-	-	-	75.0	-	-	-	25.0	-	-		
	c/e	-	-	-	-	-	-	1.500	-	-	-	0.500	-	-		
8	N	-	3	-	-	-	-	2	-	-	-	-	-	-	5	120
	%	-	60.0	-	-	-	-	40.0	-	-	-	-	-	-		
	c/e	-	1.500	-	-	-	-	1.000	-	-	-	-	-	-		
9		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	N	-	3	1	6	-	1	5	2	5	1	4	-	.	28	480
	%	-	10.7	3.6	21.4	-	3.6	17.9	7.1	17.9	3.6	14.3	-	-		
	c/e	-	0.375	0.125	0.750	-	0.125	0.625	0.250	0.625	0.125	0.500	-	-		

Table 1.9. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 15-16 August 1980.

Site		Species Captured													Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT		
3	N	-	2	-	4	1	6	5	2	9	3	2	-	-	34	120
	%	-	5.9	-	11.8	2.9	17.6	14.7	5.9	26.5	8.8	5.9	-	-		
	c/e	-	1.000	-	2.000	0.500	3.000	2.500	1.000	4.500	1.500	1.000	-	-		
6	N	-	2	-	9	-	2	5	-	1	-	3	-	-	22	120
	%	-	9.1	-	40.9	-	9.1	22.7	-	4.5	-	13.6	-	-		
	c/e	-	1.000	-	4.500	-	1.000	2.500	-	0.500	-	1.500	-	-		
7	N	-	-	-	-	-	5	5	2	4	1	5	-	-	22	125
	%	-	-	-	-	-	22.7	22.7	9.1	18.2	4.5	22.7	-	-		
	c/e	-	-	-	-	-	2.400	2.400	0.960	1.920	0.480	2.400	-	-		
8	N	2	-	-	-	-	3	-	-	3	-	-	-	-	8	120
	%	25.0	-	-	-	-	37.5	-	-	37.5	-	-	-	-		
	c/e	1.000	-	-	-	-	1.500	-	-	1.500	-	-	-	-		
9	N	-	-	-	-	3	1	1	-	-	-	2	-	-	7	120
	%	-	-	-	-	42.9	14.3	14.3	-	-	-	28.6	-	-		
	c/e	-	-	-	-	1.500	0.500	0.500	-	-	-	1.000	-	-		
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	N	2	4	-	13	4	17	16	4	17	4	12	-	-	93	605
	%	2.2	4.3	-	14.0	4.3	18.3	17.2	4.3	18.3	4.3	12.9	-	-		
	c/e	0.198	0.397	-	1.289	0.397	1.686	1.587	0.397	1.686	0.397	1.190	-	-		

Table 1.10. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 6-7 September 1980.

Site		Species Captured													Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT		
3	N	-	-	12	11	-	7	1	-	1	2	1	-	-	35	110
	%	-	-	34.3	31.4	-	20.0	2.9	-	2.9	5.7	2.9	-	-		
	c/e	-	-	6.545	6.000	-	3.818	0.545	-	0.545	1.091	0.545	-	-		
6	N	-	-	14	10	-	4	28	1	1	4	4	-	-	66	115
	%	-	-	21.2	15.2	-	6.1	42.4	1.5	1.5	6.1	6.1	-	-		
	c/e	-	-	7.304	5.217	-	2.087	14.609	0.522	0.522	2.087	2.087	-	-		
7	N	-	-	-	2	-	5	3	-	4	-	1	-	-	15	125
	%	-	-	-	13.3	-	33.3	20.0	-	26.7	-	6.7	-	-		
	c/e	-	-	-	0.960	-	2.400	1.440	-	1.920	-	0.480	-	-		
8	N	1	-	30	10	-	-	-	-	1	-	-	-	-	42	120
	%	2.4	-	71.4	23.8	-	-	-	-	2.4	-	-	-	-		
	c/e	0.500	-	15.000	5.000	-	-	-	-	0.500	-	-	-	-		
9	N	-	-	-	-	-	19	5	-	-	1	1	-	-	26	120
	%	-	-	-	-	-	73.1	19.2	-	-	3.8	3.8	-	-		
	c/e	-	-	-	-	-	9.500	2.500	-	-	0.500	0.500	-	-		
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	N	1	-	56	33	-	35	37	1	7	7	7	-	-	184	590
	%	0.5	-	30.4	17.9	-	19.0	20.1	0.5	3.8	3.8	3.8	-	-		
	c/e	0.102	-	5.695	3.356	-	3.559	3.763	0.102	0.712	0.712	0.712	-	-		

Table 1.11. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 7-9 January 1981.

		Species Captured														
Site		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT	Total	Minutes Set
3		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7	N	-	-	2	-	-	-	-	-	-	-	4	-	-	6	150
	%	-	-	33.3	-	-	-	-	-	-	-	66.7	-	-		
	c/e	-	-	1.800	-	-	-	-	-	-	-	1.600	-	-		
8		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9	N	-	-	4	-	1	13	-	-	-	-	-	-	-	18	160
	%	-	-	22.2	-	5.6	72.2	-	-	-	-	-	-	-		
	c/e	-	-	1.500	-	0.375	4.875	-	-	-	-	-	-	-		
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13	N	-	1	-	-	4	-	-	-	-	-	-	1	-	6	80
	%	-	16.7	-	-	66.7	-	-	-	-	-	-	16.7	-		
	c/e	-	0.750	-	-	3.000	-	-	-	-	-	-	0.750	-		
12	N	-	-	4	-	-	10	-	-	-	-	-	-	-	14	140
	%	-	-	28.6	-	-	71.4	-	-	-	-	-	-	-		
	c/e	-	-	1.714	-	-	4.286	-	-	-	-	-	-	-		
11	N	-	-	3	3	-	-	-	-	-	-	-	-	-	6	15
	%	-	-	50.0	50.0	-	-	-	-	-	-	-	-	-		
	c/e	-	-	12.000	12.000	-	-	-	-	-	-	-	-	-		
Total	N	-	1	13	3	5	23	-	-	-	-	4	1	-	50	545
	%	-	2.0	26.0	6.0	10.0	46.0	-	-	-	-	8.0	2.0	-		
	c/e	-	0.110	1.431	0.330	0.551	2.532	-	-	-	-	0.440	0.110	-		

Table 1.12. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 20-23 March 1981.

		Species Captured														
Site		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	ELPT	Total	Minutes Set
3		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7	N	-	2	4	1	-	1	-	-	-	-	3	-	-	11	330
	%	-	18.2	36.4	9.1	-	9.1	-	-	-	-	27.3	-	-	-	-
	c/e	-	0.364	0.727	0.182	-	0.182	-	-	-	-	0.546	-	-	-	-
8		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9	N	-	-	7	-	-	3	-	-	-	-	-	-	-	10	140
	%	-	-	70.0	-	-	30.0	-	-	-	-	-	-	-	-	-
	c/e	-	-	3.000	-	-	1.286	-	-	-	-	-	-	-	-	-
4		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11	N	-	-	-	-	1	-	-	-	-	-	-	-	-	1	180
	%	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-
	c/e	-	-	-	-	0.333	-	-	-	-	-	-	-	-	-	-
12	N	-	4	5	-	1	10	-	3	-	7	1	-	-	31	280
	%	1	12.9	16.1	-	3.2	32.3	-	9.7	-	22.6	3.2	-	-	-	-
	c/e	-	0.857	1.071	-	0.214	2.143	-	0.643	-	1.500	0.214	-	-	-	-
13	N	1	-	-	-	1	-	-	-	-	-	-	-	-	2	135
	%	50.0	-	-	-	50.0	-	-	-	-	-	-	-	-	-	-
	c/e	0.444	-	-	-	0.444	-	-	-	-	-	-	-	-	-	-
Total	N	1	6	16	1	3	14	-	3	-	7	4	-	-	55	1065
	%	1.8	10.9	29.1	1.8	5.5	25.5	-	5.5	-	12.7	7.3	-	-	-	-
	c/e	0.056	0.338	0.901	0.056	0.169	0.789	-	0.169	-	0.394	0.225	-	-	-	-

APPENDIX 2

Table 2.1. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 25 July 1979.

Site		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC	Total	Minutes Set
Freshwater Cr	N	4	3	-	-	-	1	7	-	2	2	3	22	120
	%	18.2	13.6	-	-	-	4.5	31.8	-	9.1	9.1	13.6		
	c/e	2.000	1.500	-	-	-	0.500	3.500	-	1.000	1.000	1.500		
Mayogiak	N	5	2	-	4	-	-	-	-	2	-	-	13	105
	%	38.5	15.4	-	30.8	-	-	-	-	15.4	-	-		
	c/e	2.857	1.143	-	2.286	-	-	-	-	1.143	-	-		
Reindeer Cr	N	5	13	-	8	-	-	-	-	11	1	4	42	110
	%	11.9	31.0	-	19.0	-	-	-	-	26.2	2.4	9.5		
	c/e	2.727	7.091	-	4.364	-	-	-	-	6.000	0.545	2.182		
Total	N	14	18	-	12	-	1	7	-	15	3	7	77	335
	%	18.2	23.4	-	15.6	-	1.3	9.1	-	19.5	3.9	9.1		
	c/e	2.507	3.224	-	2.149	-	0.179	1.254	-	2.687	0.537	1.254		

Table 2.2. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 9 August 1979.

Site		Species Captured											Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC		
Freshwater Cr	N	4	1	-	3	-	-	3	-	7	1	1	20	135
	%	20.0	5.0	-	15.0	-	-	15.0	-	35.0	5.0	5.0		
	c/e	1.778	0.444	-	1.333	-	-	1.333	-	3.111	0.444	0.444		
Mayogiak	N	10	8	-	13	2	-	-	-	2	-	2	37	135
	%	27.0	21.6	-	35.1	5.4	-	-	-	5.4	-	5.4		
	c/e	4.444	3.556	-	5.778	0.889	-	-	-	0.889	-	0.889		
Reindeer Cr	N	1	3	-	3	-	-	1	-	5	3	2	18	120
	%	5.6	16.7	-	16.7	-	-	5.6	-	27.8	16.7	11.1		
	c/e	0.500	1.500	-	1.500	-	-	0.500	-	2.500	1.500	1.000		
Total	N	15	12	-	19	2	-	4	-	14	4	5	75	390
	%	20.0	16.0	-	25.3	2.7	-	5.3	-	18.7	5.3	6.7		
	c/e	2.308	1.846	-	2.923	0.308	-	0.615	-	2.154	0.615	0.769		

Table 2.3. Numbers (N), percentage (%) and catch-per-unit-effort (c/e) for fish captured in Swedish survey-type gillnets at each sampling site in Tuktoyaktuk Harbour, 29 August 1979.

Site		Species Captured											Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	PCHR	RNSM	SFCD	STFL	ARFL	FHSC		
Freshwater Cr	N	7	8	8	18	1	9	7	-	2	2	8	70	200
	%	10.4	11.4	11.4	25.7	1.5	12.9	10.0	-	2.9	2.9	11.4		
	c/e	2.100	2.400	2.400	5.400	0.300	2.700	2.100	-	0.600	0.600	2.400		
Mayogiak	N	4	10	-	3	-	1	2	-	2	-	3	25	165
	%	16.0	40.0	-	12.0	-	4.0	8.0	-	8.0	-	12.0		
	c/e	1.455	3.636	-	1.091	-	0.364	0.727	-	0.727	-	1.091		
Reindeer Cr	N	1	3	-	6	1	-	-	-	1	-	-	12	120
	%	8.3	25.0	-	50.0	8.3	-	-	-	8.3	-	-		
	c/e	0.500	1.500	-	3.000	0.500	-	-	-	0.500	-	-		
Total	N	12	21	8	27	2	10	9	-	5	2	11	107	485
	%	11.2	19.6	7.5	25.2	1.9	9.3	8.4	-	4.7	1.9	10.3		
	c/e	1.485	2.598	0.990	3.340	0.247	1.237	1.113	-	0.619	0.247	1.361		

APPENDIX 3

Table 3.1. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in shore-based gillnets at each sampling site in Tuktoyaktuk Harbour, 20-22 July 1980.

Site		Species Captured											Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	SFCD	STFL	ARFL	FHSC	BRBI		
21	N	14	1	-	-	3	-	-	1	-	-	-	19	125
	%	73.7	5.3	-	-	15.8	-	-	5.3	-	-	-		
	c/e	6.720	0.480	-	-	1.440	-	-	0.480	-	-	-		
22	N	2	-	-	-	1	-	-	1	-	-	-	4	120
	%	50.0	-	-	-	25.0	-	-	25.0	-	-	-		
	c/e	1.000	-	-	-	0.500	-	-	0.500	-	-	-		
23[a]	N	-	-	-	-	-	-	-	3	1	-	-	4	135
	%	-	-	-	-	-	-	-	75.0	25.0	-	-		
	c/e	-	-	-	-	-	-	-	1.333	0.444	-	-		
24	N	1	-	-	-	2	-	-	1	-	2	-	6	135
	%	16.7	-	-	-	33.3	-	-	16.7	-	33.3	-		
	c/e	0.444	-	-	-	0.889	-	-	0.444	-	0.889	-		
25	N	6	1	-	-	3	-	-	6	3	1	-	20	130
	%	30.0	5.0	-	-	15.0	-	-	30.0	15.0	5.0	-		
	c/e	2.769	0.462	-	-	1.385	-	-	2.769	1.385	0.462	-		
26[a]	N	1	-	-	-	1	-	-	3	1	-	-	6	130
	%	16.7	-	-	-	16.7	-	-	50.0	16.7	-	-		
	c/e	0.462	-	-	-	0.462	-	-	1.385	0.462	-	-		
27	N	2	-	-	-	2	-	1	10	3	-	-	18	120
	%	11.1	-	-	-	11.1	-	5.6	55.6	16.7	-	-		
	c/e	1.000	-	-	-	1.000	-	0.500	5.000	1.500	-	-		
28	N	4	-	1	-	8	-	-	4	-	-	-	17	135
	%	23.5	-	5.9	-	47.1	-	-	23.5	-	-	-		
	c/e	1.778	-	0.444	-	3.556	-	-	1.778	-	-	-		
29	N	14	3	-	-	1	3	-	2	1	10	-	34	120
	%	41.2	8.8	-	-	2.9	8.8	-	5.9	2.9	29.4	-		
	c/e	7.000	1.500	-	-	0.500	1.500	-	1.000	0.500	5.000	-		
30	N	4	3	1	-	3	-	-	2	-	7	-	20	134
	%	20.0	15.0	5.0	-	15.0	-	-	10.0	-	35.0	-		
	c/e	1.778	1.333	0.444	-	1.333	-	-	0.889	-	3.111	-		
31	N	5	-	9	-	13	-	-	3	-	24	-	54	120
	%	9.3	-	16.7	-	24.1	-	-	5.6	-	44.4	-		
	c/e	2.500	-	4.500	-	6.500	-	-	1.500	-	12.0	-		
33	N	26	3	8	-	5	-	-	-	1	6	-	49	120
	%	53.1	6.1	16.3	-	10.2	-	-	-	2.0	12.2	-		
	c/e	13.00	1.500	4.000	-	2.500	-	-	-	0.500	3.000	-		
34[a]	N	-	-	-	-	-	-	-	-	-	-	-	0	105
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
35[a]	N	-	-	-	-	-	-	-	-	-	-	-	0	120
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
Total														
	N(51mm)	78	11	19	-	41	3	1	30	8	50	-	241	1260
	(70mm)	1	-	-	-	1	-	-	6	2	-	-	10	490
	%(51mm)	32.4	4.6	7.9	-	17.0	1.2	0.4	12.4	3.3	20.7	-		
	(70mm)	10.0	0.0	0.0	-	10.0	0.0	0.0	60.0	20.0	0.0	-		
	c/e(51mm)	3.714	0.524	0.905	-	1.952	0.143	0.048	1.429	0.381	2.381	-		
	(70mm)	0.122	-	-	-	0.122	-	-	0.735	0.245	-	-		

[a]Indicates that 70 mm (bar measure) gillnet was used.

Table 3.2. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in shore-based gillnets at each sampling site in Tuktoyaktuk Harbour, 28-30 July 1980.

Site		Species Captured											Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	SFCD	STFL	ARFL	FHSC	BRBT		
21	N	5	3	-	-	-	-	-	-	-	-	-	8	125
	%	62.5	37.5	-	-	-	-	-	-	-	-	-		
	c/e	2.400	1.440	-	-	-	-	-	-	-	-	-		
22	N	3	2	-	-	-	-	-	-	1	-	-	6	120
	%	50.0	33.3	-	-	-	-	-	-	16.7	-	-		
	c/e	1.500	1.000	-	-	-	-	-	-	0.500	-	-		
23	N	-	-	-	-	-	-	-	-	-	-	-	0	135
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
24	N	4	1	-	-	-	-	-	1	1	-	-	7	135
	%	57.1	14.3	-	-	-	-	-	14.3	14.3	-	-		
	c/e	1.778	0.444	-	-	-	-	-	0.444	0.444	-	-		
25	N	2	-	-	-	-	-	-	-	-	-	-	2	130
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	0.923	-	-	-	-	-	-	-	-	-	-		
26	N	-	1	-	-	-	-	1	-	1	-	-	3	130
	%	-	33.3	-	-	-	-	33.3	-	33.3	-	-		
	c/e	-	0.462	-	-	-	-	0.462	-	0.462	-	-		
27	N	2	2	-	-	1	-	-	-	-	-	-	5	120
	%	40.0	40.0	-	-	20.0	-	-	-	-	-	-		
	c/e	1.000	1.000	-	-	0.500	-	-	-	-	-	-		
28	N	4	-	-	-	-	-	-	-	-	-	-	4	135
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	1.778	-	-	-	-	-	-	-	-	-	-		
29[a]	N	1	-	-	-	-	-	-	-	-	-	-	1	120
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	0.500	-	-	-	-	-	-	-	-	-	-		
30[a]	N	2	-	-	-	1	-	-	2	1	-	-	6	135
	%	33.3	-	-	-	16.7	-	-	33.3	16.7	-	-		
	c/e	0.889	-	-	-	0.444	-	-	0.889	0.444	-	-		
31	N	2	-	-	-	-	-	-	-	1	1	-	4	120
	%	50.0	-	-	-	-	-	-	-	25.0	25.0	-		
	c/e	1.000	-	-	-	-	-	-	-	0.500	0.500	-		
33	N	8	7	-	-	4	1	-	-	-	-	-	20	120
	%	40.0	35.0	-	-	20.0	10.0	-	-	-	-	-		
	c/e	4.000	3.500	-	-	2.000	0.500	-	-	-	-	-		
34	N	-	-	-	-	-	-	-	-	-	-	-	0	105
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
35	N	-	-	-	-	-	1	-	-	-	-	-	1	120
	%	-	-	-	-	-	100.0	-	-	-	-	-		
	c/e	-	-	-	-	-	0.500	-	-	-	-	-		
Total	N(51mm)	30	16	-	-	5	2	1	1	4	1	-	60	1495
	(70mm)	3	-	-	-	1	-	-	2	1	-	-	7	255
	%(51mm)	50.0	26.7	0.0	0.0	8.3	3.3	1.7	1.7	6.7	1.7	0.0		
	(70mm)	42.9	0.0	0.0	0.0	14.3	0.0	0.0	28.6	14.3	0.0	0.0		
	c/e (51mm)	1.204	0.642	0.000	0.000	0.201	0.080	0.040	0.040	0.161	0.040	0.000		
	(70mm)	0.706	0.000	0.000	0.000	0.235	0.000	0.000	0.471	0.235	0.000	0.000		

[a]Indicates that 70 mm (bar measure) gillnet was used.

Table 3.3. Number (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in shore-based gillnets at each sampling site in Tuktoyaktuk Harbour, 4-7 August 1980.

Site		Species Captured											Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	SFCD	STFL	ARFL	FHSC	BRBT		
21	N	4	2	1	-	1	-	-	-	1	-	-	9	60
	%	44.4	22.2	11.1	-	11.1	-	-	-	11.1	-	-		
	c/e	4.000	2.000	1.000	-	1.000	-	-	-	1.000	-	-		
22	N	5	2	-	-	-	-	-	-	1	1	-	9	55
	%	55.6	22.2	-	-	-	-	-	-	11.1	11.1	-		
	c/e	5.455	2.182	-	-	-	-	-	-	1.091	1.091	-		
23[a]	N	-	-	-	-	-	-	-	-	-	-	-	0	65
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
24	N	5	3	-	-	-	-	-	1	1	-	-	10	65
	%	50.0	30.0	-	-	-	-	-	10.0	10.0	-	-		
	c/e	4.615	2.769	-	-	-	-	-	0.923	0.923	-	-		
25	N	27	1	-	-	-	-	-	3	-	-	-	31	115
	%	87.1	3.2	-	-	-	-	-	9.7	-	-	-		
	c/e	14.087	0.522	-	-	-	-	-	1.565	-	-	-		
26	N	6	-	-	-	-	-	-	-	1	-	-	7	115
	%	85.7	-	-	-	-	-	-	-	14.3	-	-		
	c/e	3.130	-	-	-	-	-	-	-	0.522	-	-		
27	N	2	1	-	-	-	-	-	3	-	-	-	6	125
	%	33.3	16.7	-	-	-	-	-	50.0	-	-	-		
	c/e	0.960	0.480	-	-	-	-	-	1.440	-	-	-		
28	N	24	2	-	-	1	-	-	4	1	1	-	33	120
	%	72.7	6.1	-	-	3.0	-	-	12.1	3.0	3.0	-		
	c/e	12.000	1.000	-	-	0.500	-	-	2.000	0.500	0.500	-		
29	N	17	5	-	-	1	-	-	-	-	-	-	23	60
	%	73.9	21.7	-	-	4.3	-	-	-	-	-	-		
	c/e	17.000	5.000	-	-	1.000	-	-	-	-	-	-		
30	N	-	1	-	-	-	-	-	-	-	-	-	1	60
	%	-	100.0	-	-	-	-	-	-	-	-	-		
	c/e	-	1.000	-	-	-	-	-	-	-	-	-		
31	N	4	3	4	-	-	-	-	1	-	2	-	14	60
	%	28.6	21.4	28.6	-	-	-	-	7.1	-	14.3	-		
	c/e	4.000	3.000	4.000	-	-	-	-	1.000	-	2.000	-		
33	N	7	3	1	1	3	-	-	-	-	3	-	18	60
	%	38.9	16.7	5.6	5.6	16.7	-	-	-	-	16.7	-		
	c/e	7.000	3.000	1.000	1.000	3.000	-	-	-	-	3.000	-		
34	N	-	-	-	-	-	-	-	-	-	-	-	0	60
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
35	N	-	-	-	-	-	2	-	-	-	-	-	2	60
	%	-	-	-	-	-	100.0	-	-	-	-	-		
	c/e	-	-	-	-	-	2.000	-	-	-	-	-		
Total														
	N(51mm)	101	23	6	1	6	2	-	12	5	7	-	163	1015
	(70mm)	-	-	-	-	-	-	-	-	-	-	-	0	65
	%(51mm)	62.0	14.1	3.7	0.6	3.7	1.2	0.0	7.4	3.1	4.3	0.0		
	(70mm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	c/e(51mm)	5.970	1.360	0.355	0.059	0.355	0.118	0.000	0.709	0.296	0.414	0.000		
	(70mm)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		

[a]Indicates that 70 mm (bar measure) gillnet was used.

Table 3.4. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in shore-based gillnets at each sampling site in Tuktoyaktuk Harbour, 10-12 August 1980.

Site		Species Captured											Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	SFCD	STFL	ARFL	FHSC	BRBT		
21	N	3	-	-	-	-	-	-	-	-	-	-	3	65
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	2.769	-	-	-	-	-	-	-	-	-	-		
22	N	3	1	-	-	1	-	-	-	-	1	-	6	60
	%	50.0	16.7	-	-	16.7	-	-	-	-	16.7	-		
	c/e	3.000	1.000	-	-	1.000	-	-	-	-	1.000	-		
23[a]	N	-	-	-	-	-	-	-	-	-	-	-	0	60
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
24	N	1	-	-	-	-	-	-	-	-	-	-	1	60
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	1.000	-	-	-	-	-	-	-	-	-	-		
25	N	11	9	-	-	-	-	-	-	-	-	-	20	70
	%	55.0	45.0	-	-	-	-	-	-	-	-	-		
	c/e	9.429	7.714	-	-	-	-	-	-	-	-	-		
26	N	7	1	-	-	-	-	-	-	-	-	-	8	70
	%	87.5	12.5	-	-	-	-	-	-	-	-	-		
	c/e	6.000	0.857	-	-	-	-	-	-	-	-	-		
27	N	1	-	-	-	-	-	-	-	-	-	-	1	70
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	0.857	-	-	-	-	-	-	-	-	-	-		
28	N	3	-	-	-	-	-	-	-	-	-	-	3	75
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	2.400	-	-	-	-	-	-	-	-	-	-		
29	N	3	2	-	-	3	-	-	-	-	1	-	9	65
	%	33.3	22.2	-	-	33.3	-	-	-	-	11.1	-		
	c/e	2.769	1.846	-	-	2.769	-	-	-	-	0.923	-		
30	N	11	1	-	-	-	-	-	-	-	1	-	13	70
	%	84.6	7.7	-	-	-	-	-	-	-	7.7	-		
	c/e	9.429	0.857	-	-	-	-	-	-	-	0.857	-		
31	N	15	2	-	-	3	-	-	-	-	-	-	20	70
	%	75.0	10.0	-	-	15.0	-	-	-	-	-	-		
	c/e	12.857	1.714	-	-	2.571	-	-	-	-	-	-		
33	N	11	3	-	-	3	-	-	-	-	-	-	17	70
	%	64.7	17.6	-	-	17.6	-	-	-	-	-	-		
	c/e	9.429	2.571	-	-	2.571	-	-	-	-	-	-		
34	N	-	-	-	-	-	-	-	-	-	-	-	0	60
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
35[a]	N	-	-	-	-	-	-	-	-	-	-	-	0	60
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
Total														
N(51mm)		69	19	-	-	10	-	-	-	-	3	-	101	805
(70mm)		-	-	-	-	-	-	-	-	-	-	-	0	120
%(51mm)		68.3	18.8	0.0	0.0	9.9	0.0	0.0	0.0	0.0	3.0	0.0		
(70mm)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
c/e(51mm)		5.143	1.416	0.000	0.000	0.745	0.000	0.000	0.000	0.000	0.224	0.000		
(70mm)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		

[a]Indicates that 70 mm (bar measure) gillnet was used.

Table 3.5. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in shore-based gillnets at each sampling site in Tuktoyaktuk Harbour, 17-19 August 1980.

Site		Species Captured											Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	SFCD	STFL	ARFL	FHSC	BRBT		
21	N	5	-	-	-	-	-	-	-	-	-	-	5	60
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	5.000	-	-	-	-	-	-	-	-	-	-		
22	N	1	2	-	-	-	-	-	-	-	1	-	4	60
	%	25.0	50.0	-	-	-	-	-	-	-	25.0	-		
	c/e	1.000	2.000	-	-	-	-	-	-	-	1.000	-		
23[a]	N	-	-	-	-	-	-	-	-	-	-	-	0	85
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
24[a]	N	1	-	-	-	-	-	-	-	-	-	-	1	60
	%	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	1.000	-	-	-	-	-	-	-	-	-	-		
25	N	2	2	-	-	-	-	-	-	-	-	-	4	60
	%	50.0	50.0	-	-	-	-	-	-	-	-	-		
	c/e	2.000	2.000	-	-	-	-	-	-	-	-	-		
26	N	-	-	-	-	-	-	-	-	-	-	-	0	60
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
27	N	2	2	-	-	1	-	-	1	1	-	-	7	60
	%	28.6	28.6	-	-	14.3	-	-	14.3	14.3	-	-		
	c/e	2.000	2.000	-	-	1.000	-	-	1.000	1.000	-	-		
28	N	4	-	-	-	-	-	-	3	1	-	-	8	55
	%	50.0	-	-	-	-	-	-	37.5	12.5	-	-		
	c/e	4.364	-	-	-	-	-	-	3.273	1.091	-	-		
29	N	-	-	-	-	-	-	-	-	-	-	-	0	60
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
30	N	1	2	-	-	-	-	-	4	-	-	-	7	60
	%	14.3	28.6	-	-	-	-	-	57.1	-	-	-		
	c/e	1.000	2.000	-	-	-	-	-	4.000	-	-	-		
31	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
33	N	1	1	1	-	-	1	-	-	-	-	-	4	75
	%	25.0	25.0	25.0	-	-	25.0	-	-	-	-	-		
	c/e	0.800	0.800	0.800	-	-	0.800	-	-	-	-	-		
34	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
35	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-		
Total														
N(51mm)		16	9	1	-	1	1	-	8	2	1	-	39	550
(70mm)		1	-	-	-	-	-	-	-	-	-	-	1	145
%(51mm)		41.0	23.1	2.6	-	2.6	2.6	-	20.5	5.1	2.6	-		
(70mm)		100.0	0.0	0.0	-	0.0	0.0	-	0.0	0.0	0.0	-		
c/e(51mm)		1.745	0.982	0.109	-	0.109	0.109	-	0.873	0.218	0.109	-		
(70mm)		0.414	0.000	0.000	-	0.000	0.000	-	0.000	0.000	0.000	-		

[a]Indicates that 70 mm (bar measure) gillnet was used.

Table 3.6. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in shore-based gillnets at each sampling site in Tuktoyaktuk Harbour, 4-6 September 1980.

Site		Species Captured												Minutes
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	SFCD	STFL	ARFL	FHSC	BRBT	Total	Set
21	N	8	2	-	-	1	-	-	-	-	3	-	14	65
	%	57.1	14.3	-	-	7.1	-	-	-	-	21.4	-		
	c/e	7.385	1.846	-	-	0.923	-	-	-	-	2.769	-		
22[a]	N	1	-	-	2	1	-	-	-	2	-	-	6	65
	%	16.7	-	-	33.3	16.7	-	-	-	33.3	-	-		
	c/e	0.923	-	-	1.846	0.923	-	-	-	1.846	-	-		
23[a]	N	3	1	-	-	-	-	-	-	1	1	-	6	60
	%	50.0	16.7	-	-	-	-	-	-	16.7	16.7	-		
	c/e	3.000	1.000	-	-	-	-	-	-	1.000	1.000	-		
24	N	2	2	-	-	1	-	-	-	-	1	-	6	60
	%	33.3	33.3	-	-	16.7	-	-	-	-	16.7	-		
	c/e	2.000	2.000	-	-	1.000	-	-	-	-	1.000	-		
25	N	8	5	-	-	2	-	-	-	-	2	-	17	70
	%	47.1	29.4	-	-	1.8	-	-	-	-	11.8	-		
	c/e	6.857	4.286	-	-	1.714	-	-	-	-	1.714	-		
26	N	7	3	-	-	-	-	-	-	3	1	-	14	70
	%	50.0	21.4	-	-	-	-	-	-	21.4	7.1	-		
	c/e	6.000	2.571	-	-	-	-	-	-	2.571	0.857	-		
27	N	3	-	-	-	5	-	-	1	-	-	-	9	75
	%	33.3	-	-	-	55.6	-	-	11.1	-	-	-		
	c/e	2.400	-	-	-	4.000	-	-	0.800	-	-	-		
28	N	4	-	-	-	1	-	-	-	-	1	-	6	70
	%	66.7	-	-	-	16.7	-	-	-	-	16.7	-		
	c/e	3.429	-	-	-	0.857	-	-	-	-	0.857	-		
29	N	12	4	-	-	-	-	-	-	-	4	-	20	75
	%	60.0	20.0	-	-	-	-	-	-	-	20.0	-		
	c/e	9.600	3.200	-	-	-	-	-	-	-	3.200			
30	N	5	6	-	-	1	-	-	1	-	-	-	13	65
	%	38.5	46.2	-	-	7.7	-	-	7.7	-	-	-		
	c/e	4.615	5.538	-	-	0.923	-	-	0.923	-	-	-		
31	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	c/e													
33	N	6	1	-	-	-	-	-	-	-	2	-	9	80
	%	66.7	11.1	-	-	-	-	-	-	-	22.2	-		
	c/e	6.000	0.750	-	-	-	-	-	-	-	1.500	-		
34	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	c/e													
35	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	c/e													
Total														
N(51mm)		55	23	-	-	11	-	-	2	3	14	-	108	630
(70mm)		4	1	-	2	1	-	-	-	3	1	-		
%(51mm)		50.9	21.3	-	0.0	10.2	-	-	1.9	2.8	13.0	-		
(70mm)		33.3	8.3	-	16.7	8.3	-	-	0.0	25.0	8.3	-		
c/e(51mm)		5.238	2.190	-	0.000	1.048	-	-	0.190	0.286	1.333	-		
(70mm)		1.920	0.480	-	0.960	0.480	-	-	0.000	1.440	0.480	-		

[a] Indicates that 70 mm (bar measure) gillnet was used.

Table 3.7. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in shore-based gillnets at each sampling site in Tuktoyaktuk Harbour, 10-12 September 1980.

Site		Species Captured											Total	Minutes Set
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	SFCD	STFL	ARFL	FHSC	BBBT		
21	N	11	1	-	-	-	-	-	-	-	2	-	14	60
	%	78.6	7.1	-	-	-	-	-	-	-	14.3	-		
	c/e	11.000	1.000	-	-	-	-	-	-	-	2.000	-		
22	N	19	1	1	-	1	-	-	-	-	2	-	24	60
	%	79.2	4.2	4.2	-	4.2	-	-	-	-	8.3	-		
	c/e	19.000	1.000	1.000	-	1.000	-	-	-	-	2.000	-		
23	N	7	1	-	-	-	-	-	-	-	1	-	9	45
	%	77.8	11.1	-	-	-	-	-	-	-	11.1	-		
	c/e	9.333	1.333	-	-	-	-	-	-	-	1.333	-		
24	N	4	2	2	-	-	-	-	-	-	-	-	8	45
	%	50.0	25.0	25.0	-	-	-	-	-	-	-	-		
	c/e	5.333	2.667	2.667	-	-	-	-	-	-	-	-		
25	N	22	8	-	-	-	-	-	-	-	-	-	30	60
	%	73.3	26.7	-	-	-	-	-	-	-	-	-		
	c/e	22.000	8.000	-	-	-	-	-	-	-	-	-		
26	N	26	3	-	-	-	-	-	1	-	-	-	30	60
	%	86.7	10.0	-	-	-	-	-	3.3	-	-	-		
	c/e	26.000	3.000	-	-	-	-	-	1.000	-	-	-		
27	N	3	3	-	-	-	-	-	-	-	-	-	6	45
	%	50.0	50.0	-	-	-	-	-	-	-	-	-		
	c/e	4.000	4.000	-	-	-	-	-	-	-	-	-		
28	N	9	1	-	-	-	-	-	-	-	1	-	11	45
	%	81.8	9.1	-	-	-	-	-	-	-	9.1	-		
	c/e	12.000	1.333	-	-	-	-	-	-	-	1.333	-		
29	N	8	1	5	1	-	-	-	-	-	-	-	15	60
	%	53.3	6.7	33.3	6.7	-	-	-	-	-	-	-		
	c/e	8.000	1.000	5.000	1.000	-	-	-	-	-	-	-		
30	N	7	2	5	-	-	-	-	-	2	4	1	21	60
	%	33.3	9.5	23.8	-	-	-	-	-	9.5	19.0	4.8		
	c/e	7.000	2.000	5.000	-	-	-	-	-	2.000	4.000	1.000		
31	N	35	6	-	-	-	-	-	-	-	5	-	46	60
	%	76.1	13.0	-	-	-	-	-	-	-	10.9	-		
	c/e	35.000	6.000	-	-	-	-	-	-	-	5.000	-		
33	N	6	7	-	-	2	-	-	-	-	1	-	16	60
	%	37.5	43.8	-	-	12.5	-	-	-	-	6.3	-		
	c/e	6.000	7.000	-	-	2.000	-	-	-	-	1.000	-		
34	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	c/e													
35	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%													
	c/e													
Total	N(51mm)	157	36	13	1	3	-	-	1	2	16	1	230	660
	(70mm)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%(51mm)	68.3	15.7	5.7	0.4	1.3	-	-	0.4	0.9	7.0	0.4		
	(70mm)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	c/e(51mm)	14.273	3.273	1.182	0.091	0.273	-	-	0.091	0.182	1.455	0.091		
	(70mm)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

APPENDIX 4

Table 4.1. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in small mesh seines at each sampling site in Tuktoyaktuk Harbour, 7-10 July 1980.

Site		Species Captured												Total	Shoreline Seined (m)
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM		
S1	N	-	-	1	-	-	-	-	-	-	-	-	-	1	34
	%	-	-	100.0	-	-	-	-	-	-	-	-	-		
	c/e	-	-	2.9	-	-	-	-	-	-	-	-	-		
S2	N	-	-	1	-	-	-	-	-	-	-	-	-	1	46
	%	-	-	100.0	-	-	-	-	-	-	-	-	-		
	c/e	-	-	2.2	-	-	-	-	-	-	-	-	-		
S3	N	-	-	-	-	-	-	-	-	-	-	-	-	-	35
	%	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-		
S4	N	2	-	70	1	-	-	-	1	-	-	-	-	74	34
	%	2.7	-	94.6	1.4	-	-	-	1.4	-	-	-	-		
	c/e	5.9	-	205.9	2.9	-	-	-	2.9	-	-	-	-		
S5	N	-	-	1	3	-	-	-	-	-	-	-	-	4	34
	%	-	-	25.0	75.0	-	-	-	-	-	-	-	-		
	c/e	-	-	2.9	8.8	-	-	-	-	-	-	-	-		
S6	N	1	-	47	22	-	-	1	-	-	-	-	-	71	43
	%	1.4	-	66.2	31.0	-	-	1.4	-	-	-	-	-		
	c/e	2.3	-	109.3	51.2	-	-	2.3	-	-	-	-	-		
S7	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%														
	c/e														
S8	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%														
	c/e														
S15	N	-	-	25	20	-	-	-	-	-	-	-	-	45	46
	%	-	-	55.6	44.4	-	-	-	-	-	-	-	-		
	c/e	-	-	54.3	43.5	-	-	-	-	-	-	-	-		
Total		3	-	145	46	-	-	1	1	-	-	-	-	196	272

Table 4.2. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in small mesh seines at each sampling site in Tuktoyaktuk Harbour, 14-18 July 1980.

Site		Species Captured												Total	Shoreline Seined (m)
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM		
S1	N	-	-	84.0	13	-	-	-	-	-	-	1	-	98	38
	%	-	-	85.7	13.3	-	-	-	-	-	-	1.0	-		
	c/e	-	-	221.1	34.2	-	-	-	-	-	-	2.6	-		
S2	N	-	-	2	2	-	-	1	1	2	-	-	-	8	52
	%	-	-	25.0	25.0	-	-	12.5	12.5	25.0	-	-	-		
	c/e	-	-	3.8	3.8	-	-	1.9	1.9	3.8	-	-	-		
S3	N	-	-	-	-	-	-	-	-	-	-	-	-	-	41
	%	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-		
S4	N	-	-	194	80	-	-	-	4	-	-	-	-	278	37
	%	-	-	69.8	28.8	-	-	-	1.4	-	-	-	-		
	c/e	-	-	524.3	216.2	-	-	-	10.8	-	-	-	-		
S5	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%														
	c/e														
S6	N	3	-	7	2	-	-	-	-	-	1	-	-	13	40
	%	23.1	-	53.8	15.4	-	-	-	-	-	7.7	-	-		
	c/e	7.5	-	17.5	5.0	-	-	-	-	-	2.5	-	-		
S7	N	-	-	4	2	-	-	-	-	1	-	-	-	7	38
	%	-	-	57.1	28.6	-	-	-	-	14.3	-	-	-		
	c/e	-	-	10.5	5.3	-	-	-	-	2.6	-	-	-		
S8	N	-	-	6	6	-	-	-	-	2	-	-	-	14	47
	%	-	-	42.9	42.9	-	-	-	-	14.3	-	-	-		
	c/e	-	-	12.8	12.8	-	-	-	-	4.3	-	-	-		
S15	N	3	-	47	9	-	-	-	1	2	-	-	-	62	46
	%	4.8	-	75.8	14.5	-	-	-	1.6	3.2	-	-	-		
	c/e	6.5	-	102.2	19.6	-	-	-	2.2	4.3	-	-	-		
Total		6	-	344	114	-	-	1	6	7	1	1	-	480	339

Table 4.3. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in small mesh seines at each sampling site in Tuktoyaktuk Harbour, 23 July 1980.

Site		Species Captured												Total	Shoreline Seined (m)
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM		
S1	N	-	-	6	-	-	-	-	-	-	-	1	-	7	37
	%	-	-	85.7	-	-	-	-	-	-	-	14.3	-		
	c/e	-	-	16.2	-	-	-	-	-	-	-	2.7	-		
S2	N	-	-	-	-	-	-	-	1	-	-	-	-	1	53
	%	-	-	-	-	-	-	-	100.0	-	-	-	-		
	c/e	-	-	-	-	-	-	-	1.9	-	-	-	-		
S3	N	-	1	-	-	-	-	-	-	-	-	-	-	1	37
	%	-	100.0	-	-	-	-	-	-	-	-	-	-		
	c/e	-	2.7	-	-	-	-	-	-	-	-	-	-		
S4	N	2	-	42	169	-	1	2	1	-	-	-	-	217	67
	%	0.9	-	19.4	77.9	-	0.5	0.9	0.5	-	-	-	-		
	c/e	3.0	-	62.7	252.2	-	1.5	3.0	1.5	-	-	-	-		
S5	N	-	-	-	-	-	-	2	-	-	-	-	-	2	38
	%	-	-	-	-	-	-	100.0	-	-	-	-	-		
	c/e	-	-	-	-	-	-	5.3	-	-	-	-	-		
S6	N	-	-	-	-	-	-	1	-	-	-	-	-	1	35
	%	-	-	-	-	-	-	100.0	-	-	-	-	-		
	c/e	-	-	-	-	-	-	2.9	-	-	-	-	-		
S7	N	-	-	4	2	-	-	-	-	1	-	-	-	7	46
	%	-	-	57.1	28.6	-	-	-	-	14.3	-	-	-		
	c/e	-	-	8.7	4.3	-	-	-	-	2.2	-	-	-		
S8	N	-	-	26	3	-	-	-	-	2	-	-	1	32	56
	%	-	-	81.3	9.4	-	-	-	-	6.3	-	-	3.1		
	c/e	-	-	46.4	5.4	-	-	-	-	3.6	-	-	1.8		
S15	N	-	1	9	8	-	-	-	2	-	-	-	-	20	41
	%	-	5.0	45.0	40.0	-	-	-	10.0	-	-	-	-		
	c/e	-	2.4	22.0	19.5	-	-	-	4.9	-	-	-	-		
Total		2	2	87	182	-	1	5	4	3	-	1	1	288	410

Table 4.4. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in small mesh seines at each sampling site in Tuktoyaktuk Harbour, 31 July 1980.

Site		Species Captured												Total	Shoreline Seined (m)
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM		
S1	N	-	-	-	-	-	1	-	-	-	1	-	-	2	47
	%	-	-	-	-	-	50.0	-	-	-	50.0	-	-		
	c/e	-	-	-	-	-	2.1	-	-	-	2.1	-	-		
S2	N	-	-	-	1	-	-	-	-	-	-	-	-	1	72
	%	-	-	-	100.0	-	-	-	-	-	-	-	-		
	c/e	-	-	-	1.4	-	-	-	-	-	-	-	-		
S3	N	-	-	-	1	-	-	-	-	-	-	-	1	2	49
	%	-	-	-	50.0	-	-	-	-	-	-	-	50.0		
	c/e	-	-	-	2.0	-	-	-	-	-	-	-	2.0		
S4	N	1	-	26	76	-	-	-	-	-	1	-	-	104	61
	%	1.0	-	25.0	73.1	-	-	-	-	-	1.0	-	-		
	c/e	1.6	-	42.6	124.6	-	-	-	-	-	1.6	-	-		
S5	N	1	-	124	255	-	-	-	2	-	-	-	-	382	37
	%	0.3	-	32.5	66.8	-	-	-	0.5	-	-	-	-		
	c/e	2.7	-	335.1	689.2	-	-	-	5.4	-	-	-	-		
S6	N	1	-	109	122	-	-	-	-	-	-	-	-	242[a]	47
	%	0.4	-	45.0	50.4	-	-	-	-	-	-	-	-		
	c/e	2.1	-	231.9	259.6	-	-	-	-	-	-	-	-		
S7	N	-	1	1	1	-	-	-	2	-	-	-	-	5	49
	%	-	20.0	20.0	20.0	-	-	-	40.0	-	-	-	-		
	c/e	-	2.0	2.0	2.0	-	-	-	4.1	-	-	-	-		
S8	N	-	-	-	1	-	-	-	-	-	-	-	-	1	73
	%	-	-	-	100.0	-	-	-	-	-	-	-	-		
	c/e	-	-	-	1.4	-	-	-	-	-	-	-	-		
S15	N	-	-	-	-	-	-	-	1	-	-	-	-	1	52
	%	-	-	-	-	-	-	-	100.0	-	-	-	-		
	c/e	-	-	-	-	-	-	-	1.9	-	-	-	-		
Total		3	1	260	457	-	1	-	5	-	2	-	1	740[a]	487

[a]Includes 10 unidentified ciscoes.

Table 4.5. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in small mesh seines at each sampling site in Tuktoyaktuk Harbour, 6-7 August 1980.

Site		Species Captured												Total	Shoreline Seined (m)
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM		
S1	N	1	1	-	-	-	4	-	-	-	-	-	-	6	49
	%	16.7	16.7	-	-	-	66.7	-	-	-	-	-	-		
	c/e	2.0	2.0	-	-	-	8.2	-	-	-	-	-	-		
S2	N	-	-	-	-	-	-	1	2	-	-	-	-	3	49
	%	-	-	-	-	-	-	33.3	66.7	-	-	-	-		
	c/e	-	-	-	-	-	-	2.0	4.1	-	-	-	-		
S3	N	-	-	4	48	-	-	-	-	-	1	-	-	53	52
	%	-	-	7.5	90.6	-	-	-	-	-	1.9	-	-		
	c/e	-	-	7.7	92.3	-	-	-	-	-	1.9	-	-		
S4	N	-	-	-	-	-	-	-	-	-	-	-	-	-	56
	%	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-		
S5	N	-	-	-	-	-	-	-	-	-	-	-	-	-	40
	%	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-		
S6	N	-	-	-	11	-	-	-	-	-	-	-	-	11	46
	%	-	-	-	100.0	-	-	-	-	-	-	-	-		
	c/e	-	-	-	23.9	-	-	-	-	-	-	-	-		
S7	N	1	-	-	-	-	-	-	2	1	-	-	-	4	46
	%	25.0	-	-	-	-	-	-	50.0	25.0	-	-	-		
	c/e	2.2	-	-	-	-	-	-	4.3	2.2	-	-	-		
S8	N	-	-	2	3	-	-	-	-	-	-	-	-	5	52
	%	-	-	40.0	60.0	-	-	-	-	-	-	-	-		
	c/e	-	-	3.8	5.8	-	-	-	-	-	-	-	-		
S15	N	-	-	-	-	-	-	-	-	-	-	-	-	-	49
	%	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-		
Total		2	1	6	62	-	4	1	4	1	1	-	-	82	439

Table 4.6. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in small mesh seines at each sampling site in Tuktoyaktuk Harbour, 13 August 1980.

Site		Species Captured												Total	Shoreline Seined (m)
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM		
S1	N	-	-	-	-	-	-	-	-	-	-	-	-	-	70
	%	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-		
S2	N	-	-	18	91	-	6	1	-	4	5	-	1	126	43
	%	-	-	14.3	72.2	-	4.8	0.8	-	3.2	4.0	-	0.8		
	c/e	-	-	41.9	211.6	-	14.0	2.3	-	9.3	11.6	-	2.3		
S3	N	-	-	-	-	-	1	-	-	9	7	-	-	17	37
	%	-	-	-	-	-	5.9	-	-	52.9	41.2	-	-		
	c/e	-	-	-	-	-	2.7	-	-	24.3	18.9	-	-		
S4	N	-	-	-	2	-	-	-	-	3	-	-	-	5	55
	%	-	-	-	40.0	-	-	-	-	60.0	-	-	-		
	c/e	-	-	-	3.6	-	-	-	-	5.5	-	-	-		
S5	N	-	-	1	-	-	-	-	-	5	1	-	-	7	47
	%	-	-	14.3	-	-	-	-	-	71.4	14.3	-	-		
	c/e	-	-	2.1	-	-	-	-	-	10.6	2.1	-	-		
S6	N	-	-	-	3	-	-	-	1	3	3	-	-	10	53
	%	-	-	-	30.0	-	-	-	10.0	30.0	30.0	-	-		
	c/e	-	-	-	5.7	-	-	-	1.9	5.7	5.7	-	-		
S7	N	-	-	-	-	-	3	-	3	-	-	-	-	6	55
	%	-	-	-	-	-	50.0	-	50.0	-	-	-	-		
	c/e	-	-	-	-	-	5.5	-	5.5	-	-	-	-		
S8	N	1	2	1	4	-	-	-	-	1	-	-	-	9	46
	%	11.1	22.2	11.1	44.4	-	-	-	-	11.1	-	-	-		
	c/e	2.2	4.3	2.2	8.7	-	-	-	-	2.2	-	-	-		
S15	N	-	1	64	170	-	-	1	1	54	-	-	-	291	70
	%	-	0.3	22.0	58.4	-	-	0.3	0.3	18.6	-	-	-		
	c/e	-	1.4	91.4	242.9	-	-	1.4	1.4	77.1	-	-	-		
Total		1	3	84	270	-	10	2	5	79	16	-	1	471	476

Table 4.7. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in small mesh seines at each sampling site in Tuktoyaktuk Harbour, 19 August 1980.

Site		Species Captured												Total	Shoreline Seined (m)
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM		
S1	N	-	-	-	-	-	10	-	-	-	-	-	-	10	50
	%	-	-	-	-	-	100.0	-	-	-	-	-	-		
	c/e	-	-	-	-	-	20.0	-	-	-	-	-	-		
S2	N	-	-	-	-	-	1	-	-	-	-	-	-	1	44
	%	-	-	-	-	-	100.0	-	-	-	-	-	-		
	c/e	-	-	-	-	-	2.3	-	-	-	-	-	-		
S3	N	-	-	-	-	-	-	-	-	4	7	-	-	11	53
	%	-	-	-	-	-	-	-	-	36.4	63.6	-	-		
	c/e	-	-	-	-	-	-	-	-	7.5	13.2	-	-		
S4	N	-	-	-	1	-	-	-	1	1	-	-	-	3	37
	%	-	-	-	33.3	-	-	-	33.3	33.3	-	-	-		
	c/e	-	-	-	2.7	-	-	-	2.7	2.7	-	-	-		
S5	N	-	-	-	-	-	-	-	-	8	-	-	-	8	32
	%	-	-	-	-	-	-	-	-	100.0	-	-	-		
	c/e	-	-	-	-	-	-	-	-	25.0	-	-	-		
S6	N	-	-	1	36	-	-	-	-	7	-	-	-	44	41
	%	-	-	2.3	81.8	-	-	-	-	15.9	-	-	-		
	c/e	-	-	2.4	87.8	-	-	-	-	17.1	-	-	-		
S7	N	1	-	-	6	-	-	-	-	-	-	-	-	7	46
	%	14.3	-	-	85.7	-	-	-	-	-	-	-	-		
	c/e	2.2	-	-	13.0	-	-	-	-	-	-	-	-		
S8	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%														
	c/e														
S15	N	1	2	7	28	1	2	-	1	11	-	-	-	53	41
	%	1.9	3.8	13.2	52.8	1.9	3.8	-	1.9	20.8	-	-	-		
	c/e	2.4	4.9	17.1	68.3	2.4	4.9	-	2.4	26.8	-	-	-		
Total		2	2	8	71	1	13	-	2	31	7	-	-	137	344

Table 4.8. Numbers (N), percentage (%), and catch-per-unit-effort (c/e) for fish captured in small mesh seines at each sampling site in Tuktoyaktuk Harbour, 7-9 September 1980.

Site		Species Captured												Total	Shoreline Seines (m)
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM		
S1	N	-	-	-	1	-	-	-	-	-	-	-	-	1	40
	%	-	-	-	1.0	-	-	-	-	-	-	-	-		
	c/e	-	-	-	2.5	-	-	-	-	-	-	-	-		
S2	N	-	-	-	3	-	-	-	-	-	-	-	-	3	43
	%	-	-	-	100.0	-	-	-	-	-	-	-	-		
	c/e	-	-	-	7.0	-	-	-	-	-	-	-	-		
S3	N	-	-	1	4	-	-	-	-	-	-	-	-	5	27
	%	-	-	20.0	80.0	-	-	-	-	-	-	-	-		
	c/e	-	-	3.7	14.8	-	-	-	-	-	-	-	-		
S4	N	-	-	-	5	-	-	-	-	-	-	-	-	5	43
	%	-	-	-	100.0	-	-	-	-	-	-	-	-		
	c/e	-	-	-	11.6	-	-	-	-	-	-	-	-		
S5	N	-	-	1	1	-	-	-	-	2	4	-	-	8	38
	%	-	-	12.5	12.5	-	-	-	-	25.0	50.0	-	-		
	c/e	-	-	2.6	2.6	-	-	-	-	5.3	10.5	-	-		
S6	N	-	-	2	3	-	1	-	-	3	-	-	-	9	40
	%	-	-	22.2	33.3	-	11.1	-	-	33.3	-	-	-		
	c/e	-	-	5.0	7.5	-	2.5	-	-	7.5	-	-	-		
S7	N	-	-	-	-	-	-	-	-	-	-	-	-	-	37
	%	-	-	-	-	-	-	-	-	-	-	-	-		
	c/e	-	-	-	-	-	-	-	-	-	-	-	-		
S8	N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	%														
	c/e														
S15	N	-	-	1	5	-	-	-	-	2	2	-	-	10	41
	%	-	-	10	50.0	-	-	-	-	40.0	40.0	-	-		
	c/e	-	-	2.4	12.2	-	-	-	-	4.9	4.9	-	-		
Total		-	-	5	22	-	1	-	-	7	6	-	-	41	309

APPENDIX 5

Table 5.1. Summary for fish captured in small mesh seines in Tuktoyaktuk Harbour, 26 July 1979.

Site		Species Captured													Total
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM	PCHR	
Freshwater Cr	N	5	26	2	217	-	-	-	1	1	-	-	3	-	255
	%	2.0	10.2	0.8	85.1	-	-	-	0.4	0.4	-	-	1.2	-	
Mayogiak	N	4	6	6	28	-	3	1	-	-	-	-	2	-	76[a]
	%	5.3	7.9	7.9	36.8	-	4.0	1.3	-	-	-	-	2.6	-	
Reindeer Cr	N	3	1	3	-	-	-	-	1	-	18	-	-	-	26
	%	11.5	3.9	11.5	-	-	-	-	3.9	-	69.2	-	-	-	
Aveltkok Inlet	N	3	-	-	43	-	3	1	-	-	-	-	-	-	67
	%	4.5	-	-	64.2	-	4.5	1.5	-	-	-	-	-	-	
Total		15	50	11	288	-	6	2	2	1	18	-	5	-	424[a]

[a]Includes 26 unidentified Osmeridae.

Table 5.2. Summary for fish captured in small mesh seines in Tuktoyaktuk Harbour, 9 August 1979.

Site		Species Captured													Total
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM	PCHR	
Freshwater Cr	N	27	3	27	80	-	-	-	-	1	-	-	7	-	145
	%	18.6	2.1	18.6	55.2	-	-	-	-	0.7	-	-	4.8	-	
Mayogiak	N	2	1	12	203	-	-	-	-	-	-	-	-	-	218
	%	0.9	0.5	5.5	93.1	-	-	-	-	-	-	-	-	-	
Reindeer Cr	N	-	-	15	46	-	-	-	-	-	1	-	-	-	62
	%	-	-	24.2	74.2	-	-	-	-	-	1.6	-	-	-	
Aveltkok Inlet	N	10	1	-	9	-	-	-	-	-	2	-	-	-	42[a]
	%	23.8	2.4	-	21.4	-	-	-	-	-	4.8	-	-	-	
Total		39	5	54	338	-	-	-	-	1	3	-	7	-	467[a]

[a]Includes 20 unidentified Osmeridae.

Table 5.3. Summary for fish captured in small mesh seines in Tuktoyaktuk Harbour, 29 August 1979.

Site		Species Captured													Total
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM	PCHR	
Freshwater Cr	N	1	13	-	5	2	1	-	-	-	1	-	-	-	23
	%	4.3	56.5	-	21.7	8.7	4.3	-	-	-	4.3	-	-	-	
Mayogiak	N	1	45	2	57	-	19	-	-	-	-	-	-	-	124
	%	0.8	36.3	1.6	46.0	-	15.3	-	-	-	-	-	-	-	
Reindeer Cr	N	-	-	1	2	-	90	-	-	-	1	-	-	-	94
	%	-	-	1.1	2.1	-	95.7	-	-	-	1.1	-	-	-	
Aveltkok Inlet	N	-	3	4	6	-	-	-	-	2	-	-	-	3	18
	%	-	16.7	22.2	33.3	-	-	-	-	11.1	-	-	-	16.7	
Total		2	61	7	70	2	110	-	-	2	2	-	-	3	259

Table 5.4. Summary for fish captured in small mesh seines in Tuktoyaktuk Harbour, 26 September 1979.

Site		Species Captured													Total
		BDWT	LKWT	ARCS	LSCS	INCO	RNSM	STFL	ARFL	FHSC	NSSB	SFCD	PDSM	PCHR	
Freshwater Cr	N	1	-	7	5	-	-	-	-	19	50	-	1	-	83
	%	1.2	-	8.4	6.0	-	-	-	-	22.9	60.2	-	1.2	-	
Mayogiak	N	6	-	31	12	-	-	-	-	7	425	1	1	5	488
	%	1.2	-	6.4	2.5	-	-	-	-	1.4	87.1	0.2	0.2	1.0	
Reindeer Cr	N	-	-	8	2	-	2	-	-	-	26	-	-	-	38
	%	-	-	21.1	5.3	-	5.3	-	-	-	68.4	-	-	-	
Aveltkok Inlet	N	2	-	-	1	-	-	1	-	4	100	-	-	-	108
	%	1.9	-	-	0.9	-	-	0.9	-	3.7	92.6	-	-	-	
Total		9	-	46	20	-	2	1	-	30	601	1	2	5	717

Table 6.1. Age-length[a] relationship and condition factors (K) for broad whitefish captured in Tuktoyaktuk Harbour, 1979.

Scale Age	Sexes Combined n	Mean	SD	Range	No. Males	No. Females	K
0+				-	-	-	-
1	11	116	23.0	90-161	1	-	1.06
2	2	212	2.1	210-213	1	-	1.16
3	-	-	-	-	-	-	-
4	5	283	19.7	249-298	4	1	1.23
5	13	307	39.3	241-379	10	3	1.40
6	2	326	31.8	303-348	2	-	1.23
7	1	335	-	-	1	-	1.46
8	2	369	70.0	319-418	1	1	1.34
9	1	364	-	-	1	-	1.24
Totals	37				21	5	

[a]Fork length (mm).

Table 6.2. Age-length[a] relationship and condition factors (K) for lake whitefish captured in Tuktoyaktuk Harbour, 1979.

Scale Age	Sexes Combined n	Mean	SD	Range	No. Males	No. Females	K
0+	-	-	-	-	-	-	-
1	7	116	19.4	98-154	-	-	0.92
2	3	154	9.5	144-163	1	-	0.96
3	13	178	8.7	161-195	4	4	1.04
4	8	206	8.4	194-220	3	5	1.10
5	9	248	23.7	206-294	6	2	1.22
6	5	268	21.2	239-289	4	1	1.08
7	1	285	-	-	1	-	1.21
8	1	292	-	-	1	-	1.33
9	2	356	22.6	340-372	2	-	1.25
Totals	49				22	12	

[a]Fork length (mm).

Table 6.3. Age-length[a] relationship and condition factors (K) for Arctic cisco captured in Tuktoyaktuk Harbour, 1979.

Scale Age	Sexes Combined n	Mean	SD	Range	No. Males	No. Females	K
0+	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	1	184	-	-	1	-	0.83
5	1	223	-	-	1	-	1.13
6	2	306	14.8	295-316	2	-	1.06
7	3	351	38.6	322-395	1	2	1.21
8	9	382	17.2	350-408	1	8	1.18
9	2	390	24.0	373-407	1	1	1.15
10	-	-	-	-	-	-	-
11	2	448	10.6	440-455	-	2	1.23
Totals	20				7	13	

[a]Fork length (mm).

Table 6.4. Age-length[a] relationship and condition factors (K) for least cisco captured in Tuktoyaktuk Harbour, 1979.

Scale Age	Sexes Combined n	Mean	SD	Range	No. Males	No. Females	K
0+	-	-	-	-	-	-	-
1	1	117	-	-	-	-	0.75
2	1	129	-	-	-	1	0.70
3	1	181	-	-	1	-	0.83
4	-	-	-	-	-	-	-
5	6	242	9.4	231-258	3	3	0.86
6	4	240	15.5	220-254	3	1	0.96
7	14	271	13.5	252-295	8	6	0.96
8	12	292	13.6	275-312	-	12	0.92
9	10	307	17.6	300-330	-	10	0.99
10	3	303	21.3	280-322	1	2	1.02
11	1	401	-	-	-	1	1.33
Totals	53				16	36	

[a]Fork length (mm).

Table 6.5. Age-length[a] relationship and condition factors (K) for rainbow smelt captured in Tuktoyaktuk Harbour, 1979.

Otolith Age	Sexes Combined n	Mean	SD	Range	No. Males	No. Females	K
0+	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
6	4	229	19.2	212-253	3	1	0.72
7	5	227	12.7	210-243	4	-	0.85
8	4	230	20.4	210-256	4	-	0.76
9	2	268	29.7	247-289	2	-	0.77
10	2	256	7.8	250-261	1	1	0.72
11	-	-	-	-	-	-	-
Totals	17				14	2	

[a]Fork length (mm).